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THE NATIONAL GEOGRAPHIC MAGAZINE

School for Survival

High in the Sierra Nevada, Airmen Who May Be Forced Down Learn How to Stay Alive Until Rescued

By Curtis E. LeMay

Commanding General, Strategic Air Command, United States Air Force

THESE are the last two entries in an airman's diary, the diary of a B-26 pilot who crash-landed in Labrador in December, 1942.

Three of his crew had set out in a dinghy to get help; they were never heard from again. The other four huddled in the fuselage and, for two months, slowly starved to death as their jumbled assortment of food dwindled away: Spam, Hershey bars, caramels, Coca-Cola, peanuts, canned chicken, dates.

On January 26 the pilot wrote:

"Overcast but fairly calm. Each day, we don't see how we can last another day, but each time we manage to go on. We all smoked a pipe of tobacco this morning, and G. really got sick and I felt pretty bad, but we came out of it pretty well."

Endurance Is Not Enough

On February 3, he scribbled this final note:

"Spent a solid week in bed. Today W. died after being mentally unbalanced for several days. We are all pretty weak, but should be able to last several more days at least."

Perhaps they did. But it wasn't enough. They were found by Eskimos a month later, all dead. The ironic footnote to their tragedy is this: the Eskimos came from a village only an hour and a half's journey away by foot.

I do not cite this crew's experience in derogation. Far from it. They were gallant men who endured much—and, by the diary's evidence, endured it to the end—with courage and stubborn cheerfulness. But for me and for the command I head the moral is inescapable—endurance is not enough.

The downed airman (and we have had many go down over Red-held Korea) cannot defeat cold and hunger and isolation by sitting on his hands. He must know what to do. He must equip himself mentally and physically to do it. And he must act.

There are still, perhaps, a few "realists" around who will shrug off the loss of such crews as merely a part of the normal attrition which afflicts any operating air force. They could not be more mistaken. To the Strategic Air Command, no pilot, no bombardier, no gunner, no crew is expendable.

The reason lies embedded in hard fact: SAC's mission is to preserve the peace by presenting to the enemy the constant, poised alternative of total retaliation. So far, we have fulfilled this primary obligation. But our deterrent value in peace, and our destructive potential in war, depend alike upon our readiness to deliver a knockout atomic punch—not in a year or a month or a week, but now. Not with crews we might eventually train, but with the precision teams at our disposal today.

Why are these crews so valuable? Because they are made up of human lives and are

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The Author

For nearly five years General LeMay has headed the Nation's striking force of huge strategic bombers. An aggressive and resourceful commander, he developed standard techniques of bombing and formation flying as he led American bombers against both Germans and Japanese. During World War II he rose from major to major general, and in 1951, when only 45, he became a four-star general. A graduate of Ohio State University, he holds a degree in engineering. Since 1951 he has been a Life Trustee of the National Geographic Society.—Editor

566 U. S. Air Force, Official

A Survival Trainee in Wilderness Alaska Tunnels an Entrance into His New Home

Crews of the Strategic Air Command, if forced down in desolate terrain, must understand Nature to exist. Survival schools teach the men how to live off the land pending rescue (map, page 569). Students at the 10th Rescue Squadron School, Kotzebue Sound, are taught to build life-saving snow shelters. Two men constructed this snug dome. One remains inside, having placed top blocks in position. His partner now liberates him.

irreplaceable. Because each crew, manning its massive bomber, commands more lethal power than a whole fleet of World War II planes loaded with ordinary high explosives. Because years of intensive training are required to raise each crew to performance pitch.

The ships themselves are important, yes. But the crews are even more so. During the last war it was possible, and necessary, to send airmen into combat after only eight months of training. Many a crew flew its first mission with barely a score of hours aloft together.

Today SAC would rate such a crew as apprentices. They would have to put in another three months of work and a good 150 hours of flying time to graduate to combat-ready status. To make the first team and to become a lead crew might take them from six months to a year and a half.

Nor can even the lead crews rest on their honors. Kept in constant practice, they are never allowed to forget that their individual and group proficiency records come under ceaseless scrutiny. At regular intervals they are checked out on all minute aspects of their job, from gunnery and navigation to ditching and bail-out techniques. They know, too, that a black mark in any one airman's specialty downgrades the whole crew.

Accountants have put price tags on these thousands of hours of group flying and group training; they say, for instance, that each B-36 lead crew represents a $3,000,000 investment. They may be right. But the dollar figures tell only half the story. We can replace the money; it is extremely dubious whether we shall, in a crisis, ever be given enough time to replace the crew.

A School for Survival Is Born

It was with such thoughts in mind that I found myself, during the summer of 1948, sitting at a table at the Rod and Gun Club in Wiesbaden, Germany, talking with two fellow officers: Col. Demetrius G. Stampados and Maj. Burton T. Miller. I like hunting, and so do they. But I had just taken over as Commanding General of SAC, and we had other matters to discuss.

"Look," I said, "as you gentlemen are well aware, SAC's mission is global. Our men

567 U. S. Air Force, Offutt

General LeMay and His Crew Man Life Rafts in the Pool at Offutt Air Force Base

Once a year SAC crews practice ditching procedure. General LeMay (center, hair streaming down forehead) led his men into this pool from a diving board. All the men wear waterproof survival suits and Mae West life preservers. Each SAC bomber carries three life rafts. Two are packed into special fuselage compartments; they can be ejected automatically. Once released, they inflate themselves with carbon dioxide.

are going to be flying over some of the worst terrain in the world, and some of the most remote. Every now and again some of them are going to be dumped on it. Maybe they'll ditch, maybe they'll jump, maybe they'll crash. But their problem is going to be the same: how to survive off the land, whatever that land may be—tundra, jungle, desert, or just mountains.

"I want them trained to survive. And I want to set up schools in which they can get that training."

We batted the subject back and forth. Miller had been an outdoorsman and an ordnance expert all his life. Stampados, a peacetime big-game hunter, had become in the war a member of the British Commandos and of the Eighth Army's Long Range Desert Group, had served as an intelligence officer for the Office of Strategic Services, and had operated behind enemy lines in the Balkans and the Far East. He had learned survival techniques the hard way.

The upshot of our Wiesbaden conversations was the activation, on December 16, 1949, of SAC's 3904th Training Squadron at Camp Carson, Colorado. The school commandant: Colonel Stampados. Its research and development officer: Major Miller.

To aid Stampados in his ground-breaking work, we combed the Air Force and the ranks of Army reservists for skiers, explorers, mountaineers, trappers, woodsmen.

We were lucky. We netted men like Lt. Col. Charles A. K. Innes-Taylor, transportation officer for Admiral Byrd's 1934 Antarctic expedition and a former Canadian Mountie *; Capt. Willie Knutsen, Norwegian habitué of the Arctic (page 575)†; Per Stoen of the Arctic Indoctrination School at Nome, Alaska; survival expert Maj. L. E. Dawson; Hans Siewers, who had trapped in Greenland; M/Sgt. K. E. ("Slim") Moore, Canadian-trained dog-team handler; M/Sgt. William Ferreira, who escaped three times from German prison camps; and a swarm of volunteers

* See "Exploring the Ice Age in Antarctica," by Richard E. Byrd, NATIONAL GEOGRAPHIC MAGAZINE, October, 1935.

† See "Milestones in My Arctic Journeys," by Willie Knutsen, NATIONAL GEOGRAPHIC MAGAZINE, October, 1949.

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Edward H. Hart, Civil Aeronautics Board

Airmen in a Distress Drill Evacuate a Globemaster by Hurtling Down a Canvas Slide

Recently the Air Force and civil agencies devised a special method for emergency evacuation of the workhorse Globemaster transport. Tests proved 214 men could quit the big plane in 100 seconds. This crew practices at Brookley Air Force Base, Mobile, Alabama. The first men out descend knotted ropes (on hatch), then hold the tarpaulin for others to slide down. Numbers identify some of the test participants.

who had seen service with the ski troops and with the 10th Mountain Division in Italy.

With such a cadre of instructors, the 3904th set up shop in the Colorado Rockies as an advanced survival school. To it were channeled successive classes of SAC airmen who had taken standard survival training at the Air Force base units, using such terrain as the jungle at Ramey, Puerto Rico; the Okefinokee Swamp at Turner, Georgia; and the woodland at Lockbourne, Ohio.

They came to Carson, summer and winter, to get really intensive instruction in dealing with the kind of terrain they are most likely to encounter in a major war—the terrain of the north (map, opposite). At Carson, National Geographic photographer Volkmar Wentzel took many of the fine photographs which illustrate this account.

Success in Colorado made it clear we would need an even bigger training area to handle both our own SAC crews and those of other commands who now sought our instruction—airmen from the Far East Air Forces, from the Tactical Air Force, from Military Air Transport Service, and from the Royal Canadian Air Force. Accordingly, in 1952 we shifted the bulk of our advance work to Stead Air Force Base, 10 miles northwest of Reno, a few miles from the high Sierra Nevada, which

runs along the California-Nevada border.

Stead, a rather bleak, treeless encampment on the sagebrush flats beneath the mountains, houses the students for only five days. The rest of the 15-day course they spend in a wilderness training area, testing, under conditions of real stress, their capacity—or incapacity—to survive.

The moment these crews land at Stead they begin to realize they have left luxury behind. Debarking from trucks, they draw sleeping bags and march off across dusty roads to the square hot tents they are to occupy—and keep clean—while on the base. Next morning they stumble from their cots at 0530 to start their first day of indoctrination and appraisal.

From then on, through three grueling days, the crews eat, drink, and dream survival. Lecturers pound the facts of outdoor life into them in concentrated bursts. Civilian analysts run them through group performance tests. Jumpers refresh their knowledge of parachute technique (page 573). Radiomen check up on their skill with emergency transmitters, and instructors give them tips on terrestrial navigation.

569 Drawn by Irvin B. Alfonso

SAC's Survival Training Emphasizes the Strategic North

In a major war bomber crews would fly polar routes, hazarding snow and cold if downed. SAC's advanced school at Stead Air Force Base, Nevada, specializes in northern survival. Air Force bases are designated by open circles; towns and cities by solid circles.

An Airman's Best Friend—His Chute

One order which is rammed into them at every opportunity is this: hang on to your chute: it's an airman's best friend. They begin to understand why when they consider the catalogue of things that can be made from its canopy, shrouds, webbing, and metal fastenings. To name a few:

Blankets, bedrolls, tepees, lean-tos, snares, slingshots, fishhooks and fish lines, nets, seines, mukluks, eye shields, hats, scarves, puttees, insect hoods, splints, bandages, slings, packs, sails, snowshoes, spearheads, and signal panels (pages 573, 596, and 598).

When the crews aren't tied up in lectures and tests, they often drop into Stead's display building and study its static exhibits—deadfalls and Apache foot snares, gun traps and gill nets, rafts, lean-tos, paratepees, fish spears, racks for smoking meat, and (in some ways the most interesting of all of them) the E-1 Survival Kit (pages 574 and 580).

This 42-pound outfit, which a flyer can attach to his chute harness, contains 42 items that give him the best possible chance of surviving in any climate, any terrain. They range from a 3½-pound folding-stock rifle to a vacuum-packed sleeping bag; from five days' concentrated rations to a mosquito net; from fishing tackle to extra socks. Each item has been slimmed down to its minimum size and weight; each has been field tested.

Before students leave for the hills with this kit, they must get squared away on a primary problem of survival: how to reach land safely in the first place. Instructors at Stead remind them of some gruesome statistics: one airman out of every three who bail out leaves his plane uninjured but is hurt or killed on landing.

Some of these casualties come from smashing into trees, some from drowning under the chute, some from poor posture on impact. But others in these days of stratospheric flying stem from ignorance or forgetfulness of the hazards of jumping from high altitudes.

A man bailing out from a B-36 at 35,000 feet runs the risk of pulling his ripcord prematurely and suffering a crippling jolt. Or he may fail to use his auxiliary oxygen tank, or use it improperly, and black out.

U. S. Air Force, Official

Hungry Flyers Deep in the Everglades Stretch and Scrape a Tasty Rattlesnake

Airmen are told that the tropics, with their teeming life, offer an excellent chance for survival. These trainees, having removed the diamondback's skin (on line), prepare the meat for supper.

That doesn't mean that men shouldn't jump from a crippled ship, high up. It does mean that they must be trained, and trained again, in the essential techniques; and that, if it's at all possible, they should stick by the plane until it has lost sufficient altitude.

If a crash landing is feasible, it should be preferred to indiscriminate bail outs. It's not only safer but it gives the survivors the benefit of whatever equipment the plane is carrying, plus the use of the fuselage itself as temporary shelter and as a rescue marker.

Training Scotches False Notions

Crews that come to Stead are taught, too, that though their training here will emphasize survival procedures adapted to northern woodlands, they will do well to pick up pointers on living in the jungle, the desert, and on Arctic tundra and ice.

From training films, from the new SAC *Land Survival Guidebook*, and from talks by Stead's civilian survival experts, they garner a good deal more information than they can perhaps retain. Some of it, however, stays with them, and more will come back to them as they need it.

The basic and most useful impression that they derive, I think, is that neither jungle nor desert nor Arctic is as nightmarish as portrayed in pulp fiction. When an instructor asks a new student what would be the first thing he'd do if he came down in such country, he'll often answer, "I'd shoot myself!"

But he soon learns that in the jungle, for example, he need go neither hungry nor thirsty. He'll be able to find water in young cane stalks, juice in vines and the fruit of most trees, blood in any turtle or animal. He can eat any beast with fur on it, any palm bud, any flower without a milky or colored sap.

He's taught, too, that even if he loses the mosquito net from his E-1 pack, he can make a pretty good head protector from his T shirt. As for other insects, he's told that he can eat them—grasshoppers and certain butter-

flies (minus their wings and legs), ants and ant eggs, wood grubs from rotten logs. Not appetizing, perhaps, but nutritious. And certainly abundant. If the Australian aborigine can dine happily off snakes, lily roots, worms, and lizards, the trainee is told, why, so can he. And if an Arab considers fried locusts a treat, then a hungry American flyer shouldn't pass them up.

How to Paralyze a Fish

One tip that generally tickles the airman's imagination is the notion of using the sap from a sandbox tree to catch fish. He learns that if he mixes this stuff with sand or dirt and spreads it on a pond or stream, it will paralyze the fish so that he can scoop them up by hand. Moreover, they'll be just as edible as if hooked on a line.

Most students, of course, don't exactly look forward to a meal of roast sloth, broiled termites, and fern-shoot stew, topped off with wild figs and trumpet fruit. But they do find it distinctly reassuring to realize that the jungle holds substitutes for the corner grocery store and the post exchange.

Even the Far North, they are surprised to discover, can offer a large and remarkably varied larder to a man not too finicky and not too lazy: bats, lizards, newts, frogs, snakes, wood grubs, rock tripe, and the woolly lousewort (page 592). The over-rich liver of the polar bear, they soon gather, is better left alone; but lemmings can be tackled with some profit.

Stead's instructors naturally encounter some resistance among airmen to the idea of lunching off lichens, seaweed, and carragreen moss. But they maintain stoutly that these humble items aren't bad. They also speak well of dandelions, sea cucumbers, and mussels, though not of blue, or black, mussels, which can be poisonous during the summer in some areas.

On the subject of fish the instructors find it easier to convince the airman that he can survive with some pleasure in the Far North. They remind him that he can eat salt-water fish raw; the fresh-water ones (which may contain parasites) he had better cook (page 594). And if he manages to catch some Arctic incognito he can consider himself blessed with a gourmet's delicacy.

Admittedly, it's not easy for a student airman at Stead to switch his mind from survival on ice and tundra to survival in the desert. Yet he's ready to concede that intercontinental bombers in a global war may traverse both types of terrain in a single day and that he may have to come down on either. He also recognizes that deserts cover nearly one-fifth of the earth's land surface.

It's enough to make any pilot's mouth dry just to listen to the facts about water and desert survival. At temperatures above 90° F., his instructors inform him, dehydration of 15 percent can prove fatal; the body needs from two to three times as much water in the desert as in the jungle—at least three to four quarts a day. If a man can't get it, he'll probably die.

But if he does have water, he can make it last longer and carry him farther by "rationing his sweat"—deflecting the sun with light clothing, traveling by night if at all, living in slow motion.

If he stays close to his plane, sets up signal devices (brush and oil beacons, mirrors, flares), and spreads out parachute panels, he can maximize his chances of being picked up (page 591). As long as he has stowed enough food and water on board, he'll be safe.

In short, the instructors point out, the time to lick the desert is before you take off.

On the afternoon of their third day at Stead student crews turn from the theory of survival in varied climes and tackle thorny reality in the near-by hills.

First they draw the supplies they need in addition to their E-1 kits: first-aid boxes, parachute panels, 10 bars of pemmican (dried meat), 3 pounds of fresh beef, and 3 pounds of root vegetables. The food won't be enough to get them through the trek in comfort, but it will tide them over until they learn to live off the land.

They Take to the Hills

At 9 p. m. they take off in a convoy of six-by-sixes. For 50 miles the trucks follow the highway from Reno. Then, at Honey Lake, California, they turn to the left and begin to climb switchback roads that lead steeply through ponderosa pine to an area of razor-backed ridges and narrow upland meadows.

Here the airmen will carry out a tactical exercise which for some will prove a lark, for others an ordeal, and for all a test. Simulating a jump over remote and rugged terrain, they will "bail out" of their trucks by crews, head into the tall timber, and for the next 10 days work their way cautiously across the training area to pickup points on the eastern side. They carry maps and radios. For more precise coordinates and new directions they must contact the base by radio each night.

South of Crocker Mountain the convoy cuts west to the Grizzly Valley road. Stakes indicating bail-out stations appear every four-tenths of a mile. As each crew nears its marker, its truck slows down for a moment, and in pitch darkness the men tumble out and make themselves scarce.

At this point many a crew makes its first and worst errors. Traveling through broken country at night is difficult enough even for trained men. For flyers quite out of their element it can be anything from a farce to a nightmare.

In charge of each crew is its aircraft commander (A/C). A regular Stead instructor accompanies him; but the instructor's mission is primarily to observe, to listen, to teach by correcting mistakes, and to appraise the A/C's talent for leadership and the individual crew member's capacity to survive.

If an airman suffers a serious injury, or the A/C gives an order dangerous to the whole group, the instructor can interfere; otherwise he allows his crew to determine its own course of action, right or wrong. This kind of teaching sticks with the students.

Packing Through the High Sierras

It often happens, then, that the A/C will bail out with his bunch, look at his compass, mutter "Follow me, men!" and vanish into the scrub. He gives no instructions on trail discipline and night signals, doesn't check his contour map, doesn't arrange a rendezvous point for the first camp.

Result: his crew strings out behind him like a kindergarten class at a museum, contact is lost, and before he has gone half a mile he's short two or three men. Sometimes the instructor will round up the strays for him; sometimes he will just trail them, satisfy himself that they're getting along all right, and leave it up to the A/C to reunite his crew, if he can, and continue the trek.

For the purposes of this exercise, the A/C and his men must assume that the territory they're traversing is enemy-held. This means concealment, camouflage, caution. It means keeping to the woods and keeping off the logging roads that crisscross the area. It means few fires and small ones. It means sentries at camp and scouts on the trail.

Crews hopping off from Grizzly Valley road usually make no more than a mile before they bed down. They're up at dawn, however, to push deeper into the mountains and pitch a real camp.

Some A/C's take it slow and easy on that first day's trek. Others feel they must set some kind of cross-country record; as a consequence, by nightfall half their men may be nursing blistered feet or twanging tendons.

Next day, if the A/C feels he's hit upon a sufficiently remote and well-hidden camp site, he may set his men to smoking the beef they've brought. Using parachute panels, they build and cover a tepee of saplings (page 576), erect a rack inside, three or four feet off the ground, place the meat on it in strips, and light a slow smudge fire of green wood underneath.

A few hours' smoking preserves the meat for a week or more, even in summer. If the smoke makes too obvious a beacon, the instructor will probably suggest that they do their curing by night.

For some crews the strongest incentive to living off the land is the pemmican they carry. Actually, this dried beef-and-pork preparation, which comes in aluminum-wrapped chunks, can be made very palatable if boiled long enough and supplemented with a vegetable or two, some greens, or, if a man is lucky enough to have it, a pinch of chili powder.

But many airmen, unimpressed by the pemmican's high protein content and persuaded that "a guy just can't stomach that greasy stuff," would rather forage for something else.

Before their trek is over, they are likely to have become pretty fair scroungers. They learn to make gill nets from their chute cords and set them at strategic bottlenecks in the creeks that fan out over the training area (page 594). Some discover the chilly art of stirring up the mud of beaver ponds with their feet and, with bare hands, catching trout as they are blinded by the muddy water.

Stead's training area contains few rabbits, but ground squirrels, ground hogs, chipmunks, and porcupines abound. The airmen make snares from ripcord wires, whittle figure-4 deadfalls, set baited traps, and then, with vast pride, skin and cook their prizes (pages 570 and 578).

Porcupine in a Parachute—a Poor Dish

Appetite, of course, is the best sauce. Sometimes, however, even appetite balks at its task. One crew treed and killed a porcupine which weighed, after skinning and dressing, a good 15 pounds. Following instructions, they wrapped it in parachute cloth, soaked it overnight, and roasted it.

Unfortunately, it turned out that their chute had been warehoused in naphtha flakes. The flavor it imparted to the porcupine had to be tasted to be believed.

Even airmen with considerable camping experience can pick up many pointers from their instructor as the days go on, and remind themselves of much that they have forgotten.

They learn to avoid trichinosis by cutting doubtful meat into bite-sized pieces and cooking it thoroughly; to treat frostbite by thawing or warming the affected areas rather than by applying snow or ice; to lay out shadow signals for rescue planes in snow-covered terrain by digging trenches, lining them with spruce boughs, and piling snow highest on the south side of the letters (pages 591 and 602). They

Kodachrome by National Geographic Photographer Volkmar Wentzel

Capt. Willie Knutsen, an Experienced Arctic Explorer, Instructs a Survival Class

Few if any downed flyers would have ready-made snowshoes and tents in their survival kits. From teachers like Knutsen they learn how to improvise. One diagram explains shelters and traps; another takes aim on a rabbit.

General LeMay Inspects SAC's Survival Kit

[illegible]

Parachute Students at Camp Carson, Colorado, Learn to Keep the Wind from Rolling Them Like Tumbleweeds

This Springy Bed Requires Only Trees and Hatchet

[illegible]

A Wooden Tureen Boils Without Fire

[illegible]

14 Panels of Parachute Will Cover a Parapet

[illegible]

Snares and Deadfalls Offer Food to Those Able to Make Them

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

One Deer Like This Could Keep a Crew Alive for Weeks

[illegible]

▲ This Stretcher Rode in Miniature Looks Like a Thrill to Be Avoided

[illegible]

▼ Of All This Emergency Gear, Extra Socks May Prove Most Vital

[illegible]

"Hey! Here We Are!" Survival Trainees Signal to a Plane

[illegible]

Map or No Map, Someone Is Going to Get Lost

[illegible]

are told how to build a shelter from soft, deep snow—tamp the snow evenly with snowshoes and allow it to freeze overnight before cutting into blocks (pages 586 and 587); how to find "Indian kerosene" in dead pitch-filled evergreen branches.

A damp sleeping bag can be dried in winter without a fire, they learn—let it freeze stiff outside the tent, then knock off the frost and ice crystals with a stick.

To rig a loop set, the men are instructed to place the snare on a game trail along a slope or stream so that the weight will fall far enough to hoist the animal out of reach of hijacking predators.

Safety pins, they discover, can be made into guides for a willow fish pole, and a key-type can opener can be set in wood and sharpened into an awl, unwound and given a needle point, flattened into a screw driver, or bent into a fishhook.

Most campers, no matter how experienced, know little about woodland plants as food. They haven't had to find out. Yet, as Strand's instructors point out, the rules, at least for the North Temperate Zone, aren't hard to remember:

> Flowers of all plants are edible either raw or cooked.
>
> Almost all fruits, nuts, and berries are edible (the most common exception is the baneberry).
>
> Leaves and stems of nonpoisonous plants can be eaten raw, or, if too bitter, boiled in several changes of water.
>
> Roots, tubers, shoots, and rootstalks should be roasted, baked, or boiled.

Why Not a Venison Dinner? Too Easy!

With plenty of deer in the training area, some crew member is always sure to ask why he should bother with "rabbit food." Why not venison? The answer, of course, is that it would make survival all too easy, at least until the deer were badly thinned out.

One hindquarter of deer would feed a whole crew for the duration of its trek. They would not only waste the rest of the animal but would never learn to experiment with other food sources.

Though the airmen are not allowed actually to shoot or trap or butcher a deer, they are taught how to go about it (page 579). They practice setting the simple, reliable Apache foot snare; they construct the lethal deadfall with three-pin trigger. They also pick up the essential principles of stalking game: keep off the skyline; keep the wind in your favor; and search the terrain in all directions, preferably with the sort of monocular that comes in the E-1 kit.

Trial hunts reveal that the airmen's chances of stumbling upon game are pretty remote and that they will have to go out and spot it before they're spotted first. The Hornet rifle they'll ordinarily carry is only .22-caliber, clearly, in order to bring down any sizable animal, they will have to get to fairly close quarters.

Instructors Are Trained Men

These things they learn partly by doing, partly by talking with the instructor. In their 10-day crossing of the area they average about five miles a day; usually it means the pitching of half a dozen different camps. There's plenty of time, between chores or along the trail or around the fire at night, to chew over the day's successes and fiascos and to cross-examine the instructor on survival lore.

That instructor is likely to be a pretty unusual man. Chances are he'll be a noncom, a staff or tech sergeant. Yet he will have had at least two years of college, many years of outdoor experience, and highly specialized training in survival work.

More important, the instructor will possess the poise and judgment necessary to lead, through a grueling trek, a $3,000,000 crew, whose commander may be a lieutenant colonel, and indoctrinate them with a specific wilderness lore and with a healthy attitude toward stress itself, and, at the same time, coolly appraise the survival efficiency of each crew member from the A/C down. That takes quite a man. SAC is lucky to have found and developed as many as it has.

After handling a score of crews, an instructor at Stead is not easy to surprise. He no longer chokes when he encounters some crew member who has never seen a live cow. He begins to expect that one airman out of every two or three crews will bed down in the middle of a game trail and wake up [illegible] down the path and buckle his sleeping bag.

The instructor even becomes inured to the fact that the crew's navigator will almost certainly manage to get lost. Every crew automatically turns over its navigational problems to his "pro"; and the pro, heir of the study tables and charts that made his flying [illegible] is crew on a scenic tour around Robin Hood's barn. Then some rank amateur of a navigator

A Hole Chopped in the Ice Yields Dinner for Two

Emergency fishing gear packed in a survival kit may be used in tropical or arctic waters, in short or salt. These SAC trainees from Camp Carson use their kits here to jig for fish in the South Platte River.

or a flight engineer takes over, fishes out his Weems plotter and his map, and gets the group back on the right track.

An instructor can be amused by his crew's naivete, but occasional specimens try him sorely. These include the officer who bellies at trail discipline and tries to pull his rank on the instructor; the A C who finds himself befuddled by the unfamiliar problems of mountain survival and traces his leadership for self-pitying apathy; and the airman who discovers when the going gets rough that he is sick and should be evacuated at once.

A frequent complaint of crew members who "want out" is altitude sickness, caused by low oxygen pressure. Like all SAC flyers, they've been thoroughly briefed on the physiology of high flight and the dangers of oxygen deficiency. It's natural enough that when they begin to pant up and down the Sierra Nevada at 6,000 or 7,000 feet, usually a bit hungry, tired, and pack-sore, they should note in themselves persuasive symptoms of mountain sickness.

From then on, unless the instructor or a medical corpsman can snap them out of it, they're likely to become increasingly convinced that the strain is building up, that pressure on the heart is growing, and that they're about to black out.

Shrewd Medics on Duty

Fortunately, the school maintains some roving medics up in the area who are both sympathetic and shrewd. They can spot a malingerer at 50 yards, and they can tend to a real cardiac case with certainty and dispatch.

These medics have one advantage over doctors down at the base: they know from intimate experience what the men are up against, because they live up in the Sierra Nevada most of the time. They know that while a trek in midsummer can be merely a pleasant outing for a good camper, in winter and rough weather it can be quite an ordeal for a fakir.

Hiking under a heavy pack with a pulled tendon can become excruciatingly painful. Fighting through snowdrifts when you're wet, cold, and underfed is not necessarily fun; and drifts in the area can reach 20 to 25 feet.

Rugged days, sleepless nights, below-zero cold, the responsibility for a dozen other men under unfamiliar conditions—these can erode the morale of many an A C who never had any trouble running his crew before.

SAC's medics and instructors, indeed, tend to be less surprised at the number of men who crack up during the trek than at how many do not. They remember the officer last summer whose soles were simply strips of raw, blistered flesh but who nevertheless led his crew out of the area under full pack.

They remember the airman with severe abdominal pains who was brought almost forcibly up to a medical post, was diagnosed as having appendicitis, yet insisted on returning to his crew. Only when they drew up a paper for him to sign, absolving them of all responsibility for his death, did he agree to go down out of the hills. He was on the operating table in an hour—and, literally, not a minute too soon.

Some Radios Are Disabled

The tenth and last day of the trek finds most crews camped near the final ridge on the eastern flank of the training area. The majority have been able to maintain nightly radio communication with the base and receive the exact coordinates for their pickup.

A few, however, have damaged their transmitters, dropped their generators in some stream, or discovered that, when their crew split up, the generator carrier went one way and the transmitter man another. Such crews will be picked up anyway, their instructors having been given the rendezvous directions before they started. But the men responsible will be downgraded for an error that, under actual survival conditions, might have cost them their rescue.

To some crews the end of the trek comes as a huge relief, to others as a blow. But all of them, tanned, bristle-bearded, their boots dusty and their fatigues greasy, seem to strike along now with the sloughy assurance of veterans.

Those who hit the last cutover ridge in summer must contend with rattlesnakes basking on the exposed ledges (one crew killed 25 and captured two). Those who meet it in winter must clamber down a 2,500-foot pale-side booby-trapped with snowslides. Yet because they know they are coming down the homestretch, they somehow have a jaunty air.

Know Thyself—and Thy Crew

They have learned how to pace themselves in rugged terrain, how to care for their only means of locomotion, their feet, and how to use the equipment they carry. Most of all, they have learned how to improvise and how to help Nature to help them.

They have learned, too, a lot about each other. They have found that Joe, the bombardier who never had much to say, is the one they can depend on to bring home the bacon or the snared grouse bag. They have discovered that Bob, a fine radarman aloft, can get lost on the ground more quickly than any of them. They have come to realize that the Old Man is the kind of guy who can walk

Snow Masses Lay in Black in the Wake of an Igloo at Stead Air Force Base
An [illegible] of organized [illegible] Bases are [illegible] of [illegible] the [illegible]

[illegible] of the [illegible] Training assets were used to [illegible] the [illegible] How [illegible] will when they could [illegible] of survival. On [illegible] they are given the same [illegible] of [illegible] Sometimes it is [illegible] to make some [illegible]

Back at the base they [illegible] up [illegible] in [illegible] Even [illegible] to work [illegible] exactly [illegible] change. The instructors [illegible] have [illegible] to [illegible]

It isn't [illegible] Sometimes, when a [illegible] the instructor [illegible] up. More [illegible] throughout [illegible] to [illegible] must come to [illegible] Again [illegible] to [illegible] few [illegible] on [illegible] stress.

The instructors [illegible] and [illegible] to these [illegible] about stress, [illegible] navigation [illegible]

care and use of clothing and equipment, outdoor craft, health, attitude, physical condition, and parachute evaluation.

Each of these categories, moreover, is broken down into many subheads. Take outdoor craft. The instructor must size up the crew member on selection of campsite, erection of shelters, emergency fire methods, improvising in the field, skill with ax and knife, proper firewood, ropes and knots, and sharpening hand tools.

Or take leadership, the criterion SAC considers most important of all in appraising an A. F. We want to know how well he utilizes his man power. Does he brief his crew? Show resourcefulness? Instill confidence and respect? Exhibit calmness under stress? Take an interest in his crew's welfare and morale? Survey new situations accurately? Plan and organize? Maintain control?

The Commandant Sounds Off

We don't, of course, expect a perfect score from every aircraft commander. But those who fall can look forward to reassignment. Conversely, these crewmen, no matter what their rank, who indicate a marked aptitude for leadership can be sure their initiative will not go unnoticed. The school's evaluations become a permanent part of every airman's record.

The crews get the good—or the not-so-good—news about their ratings in a special critique. There, in the space of an hour and a half to two hours, the head of the training squadron relentlessly reviews their sins as well as their successes.

On rough-hewn log benches the men sit in groups, each crew somehow a little tougher than before, a little more conscious of its own identity. Some of the men are in blue jeans, some wear baseball caps or sombreros. A few proudly finger their week-old whiskers.

The commandant begins in jocular vein.

"Gentlemen," he's likely to say, "I congratulate you. You made it. I know many of you didn't think you would, and some of you don't care. You didn't ask to be sent here, and it didn't make you any happier when they took away your nice mattress and your soft bed and dropped you out in the rocks in the middle of the night and told you to start running.

"Your morale went bump, and you wanted to tell the whole Air Force, 'Okay, gentlemen, you can have your wings and your soldier suit back. I want out.'

"But you kept in there plugging, most of you, and you came through, and you learned something, partly about yourselves and partly about the woods. Perhaps what you learned about yourselves will prove, in the end, to be the more important to your eventual survival.

"This tactical exercise you've completed was tough. At times, I have no doubt, you experienced a flicker or two of fear. But let me remind you that the real thing will be ten times tougher. You may be seriously injured when you ditch or jump. You may be wounded before you ever leave the plane. You may come down in hostile territory with patrols hounding you day and night. Above all, you will have no certainty that you will be rescued in 10 days—or 10 months.

"In short, you will become acquainted with your greatest enemy, not hunger, not climate, not terrain, but fear. Fear can paralyze you into passive acceptance of your fate or it can shock you into panic.

"[illegible] neither, however, if you remember [illegible] rules of survival: face the facts, make a plan; keep busy; and keep trying. In short, your one dependable antidote to anxiety will be purposeful activity."

The commandant pauses. The upturned faces below him are thoughtful enough, some of the crews will be over Korea in a few weeks, practicing, perhaps, what they now hear preached. The speaker turns to his notes.

Outdoor "Surgeons" Operate on Selves

"Before I give you your ratings, let me run over a few points on your woodmanship. You appear to have been an average class. The chief medical officer warned you that the hunting knives you would carry were sharp, and that testing the blade against the left forefinger was not recommended. I observe from your instructors' reports 37 cases of laceration of the left forefinger."

They laugh. Uneasily, one or two put their hands in their pockets.

"As to navigation, you seem to have picked up some of the notions beloved by other classes, such as the belief that the best way to travel due east is to walk along keeping the sun always on your right. Around noontime, I imagine, you found it more than a little difficult.

"Others of you, I hear, felt sure that the shortest distance between two points is always a straight line, regardless of those little contour marks on the map. You fellows who encountered a mountain between your two points may have begun to wonder if Archimedes had ever done much cross-country hiking.

"In camouflage, I note in some cases an excess of artistry over common sense. I am thinking of one particularly touching spectacle I witnessed this week up in the training area. There, walking down the road, a hooed

Paddlers Abandon a Ditched C-82

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Parachute Canopies and Sod Walls Make a Hut and Willow Branches a Mattress

A. [illegible] a parachute [illegible]

B. [illegible]

"Went This Way," Says the Arrow; "Unable to Proceed," the "X" Tells Air Rescuers

▲ Aleuts Moved on an Aleutian Island Sample Seaweed Sandwich and Find It Edible

▼ [illegible]

[illegible]

"Gone to Earth!" But Not for Long. Armen Dispresses a Rose Fox

★ **Some Places Forbid Girl Nursing but the Arctic Knows No Less Save Survival**

[illegible]

[illegible]

Flyers Learn How to Stay Dry in Water

[illegible]

[illegible]

[illegible]

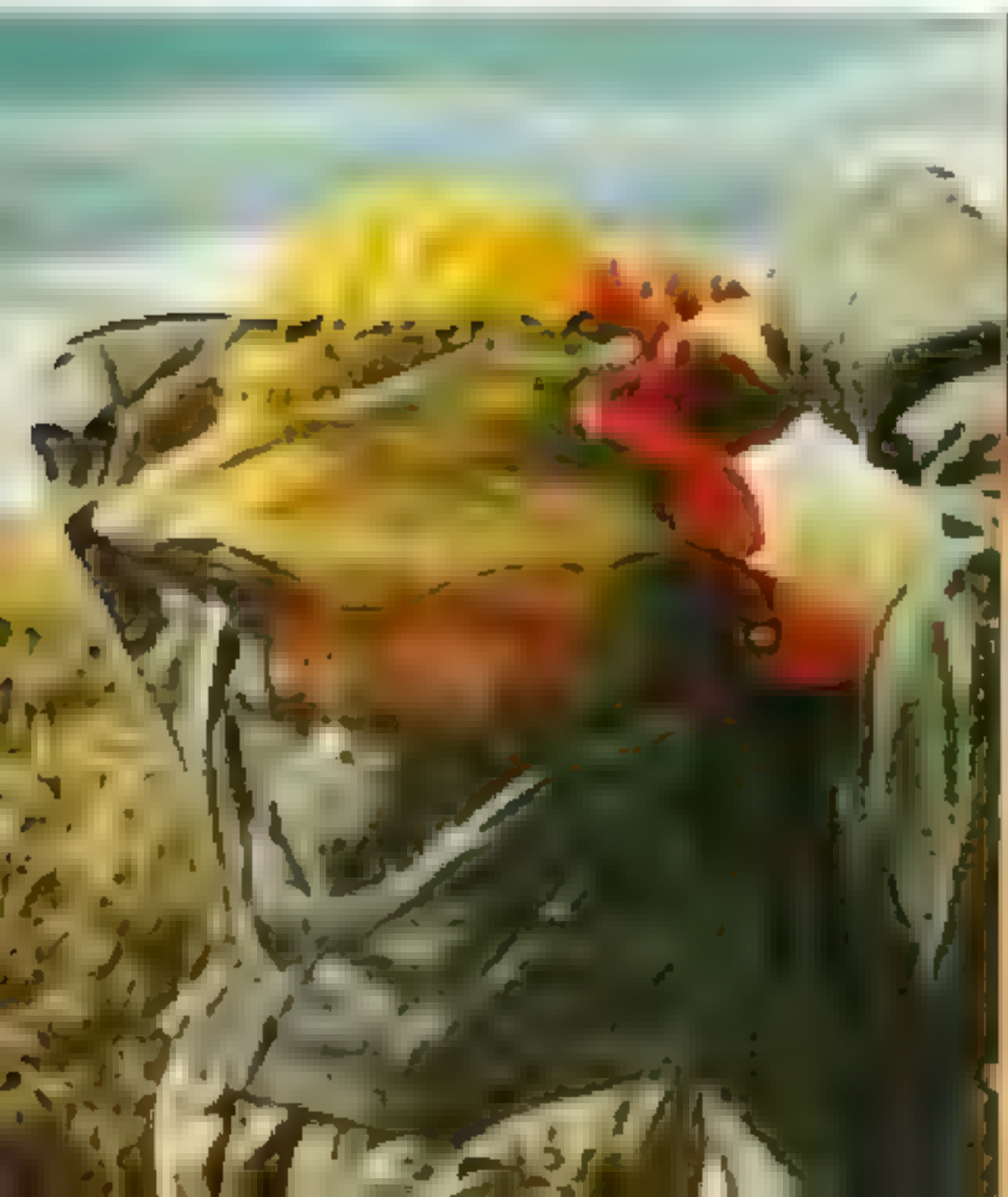
[illegible]

↑ They Also Serve When Only Set in Camp

[illegible]

↓ Tundra Mosquitoes Carry Species

[illegible]



Tommy Thompson Escapes Execution

[illegible]

[illegible]

[illegible]

One Pheasant in the Net Is Worth Ten in the Willow Bush

[illegible]

Colonial Crabs by Radar in the Aleutians

[illegible]

[illegible]

[illegible]

[illegible]

In Rescue, All's Well That Ends Well. A Helicopter Begins Evacuation from the Tundra

[illegible]

daylight, was a beautiful little Christmas tree —in GI boots."

Turning to a blackboard behind him, the commandant pins up a large chart; on it is a graph outlining the combined scores of all crews in the present class. Then his assistants hand out the individual and group ratings to the crews themselves.

They are, as the commandant has intimated, a pretty average lunch. Very few of them have failed the course; very few of them, too, have made a top score. Perhaps more significant than their marks, however, are the statistics indicating their growth in confidence. When they arrived, nearly a fifth rated themselves as "inadequate for individual and group survival." Now, at the end of the course, that ratio has shrunk to a handful.

Course Pays Off in Combat

The newly gained assurance which these crews manifest isn't misplaced, either, according to intelligence reports from Korea. About a third of SAC's crews have now gone through the course at Camp Carson or at Stead, plus trainees from other commands, and many of these crews have flown out to the Far East for a tour of battle duty.

Though bomber losses in Korea have been relatively light, and no definite conclusions are available, a significant number of fighter and fighter-bomber pilots have come down in enemy territory and have brought their SAC schooling into play.

Their comments on reaching our lines have furnished eloquent testimonials to their training.

"The stuff they taught me at SAC sure pulled me through," declared one. Said another: "It was rugged, but I never felt helpless. I knew what to do, and I did it, and I just never left myself time to get scared." A third asserted: "I remembered what I'd learned at Stead, and I kept cool, kept going—and kept my socks dry."

One of the most telling examples of what even a smattering of survival knowledge can do for a downed crew is the experience of the "Goose Bay Gang."

This contingent consisted of a B-50 bomber crew and passengers flying back to Tucson in September, 1950, from a field at Goose Bay, Labrador (map, page 569). They were about 110 miles due west of Goose Bay when three of their engines failed. They jumped.

It was an exceptionally good jump. All 16 men left the plane from about 1,700 feet at around 10 p. m., the pilot last. They came down in the spruce scrub and marshes within an area no more than four miles in diameter.

As they stowed their chutes and rendezvoused, they found that with the exception of one man who had broken his leg everyone was in condition to walk.

The aircraft commander was a young first lieutenant, Jack Thompson. He was well outranked by several of his passengers, but he accepted his responsibility for leadership unhesitatingly and made it stick. He and his crew had completed elementary survival training at their home base, and he had asked for and received a two-hour briefing at Goose Bay on living off the land in the Far North.

Taking a rapid inventory, Thompson discovered that no one had been able to bring down any emergency equipment. Two men had .45's; each man had his parachute. That was all. The radio in the plane had failed at the same time as the engines, so that the operator had had no chance to send an SOS. They were lost, and there was no telling when, if ever, they would be picked up.

Thompson didn't give them time to sit around and brood. He put several of the men to work pitching paratepees, others he detailed to gathering spruce boughs for flooring; still others he sent to forage for food and firewood. The injured man he placed in the first tent that went up, with a rough splint on his leg and a 24-hour guard to look after him.

The food detail reported no big game but plenty of cranberries and blueberries still edible beneath the [illegible] Up man shot a small bird. Scouts reported a river only a few hundred yards away.

Next morning, with the group's most immediate needs having been met, Thompson had a detachment begin construction of a raft. The men had no axes or hatchets, but they pushed over dead spruce trunks and rolled them down to the river. There they lashed them together with ropes made from their chute shrouds. Another unit [illegible] a signal in a clear, snowy space "To—Uk" while others laid smoke beacons of crisscrossed branches (page 602).

Needle in a Northern Haystack

For three days Thompson's crew waited and worked. It was no picnic. One man found he had fractured his ankle on the jump; another that he had chipped a bone in his foot. Neither of them wanted to fold up, but both were pretty well hobbled. As for the others, they tried to do what Thompson asked—forget their long-range prospects of surviving a Labrador winter and concentrate on doing a job.

Meanwhile, a joint U. S. and Royal Canadian Air Force hunt had been in progress for 72 hours, scorching the missing B-50's route, map square by map square. The hunters had

Airmen Stranded in the Labrador Wilderness Signal "16 OK" to a Rescue Helicopter

On September 21 [illegible] 16 flyers parachuted from a [illegible] 11 miles west of Goose Bay, Labrador [illegible] Employing survival training, they built shelters at [illegible] and [illegible] airmen found [illegible] the [illegible] pilot [illegible] [illegible] Here. A [illegible] and [illegible] to [illegible] and [illegible]

not [illegible] hopeless. They [illegible] when the plane [illegible] flown or whether it had been up in [illegible] plan at all. And [illegible] of all reconnaissance, could be [illegible] this.

[illegible] Sunday afternoon, a rescue pressure came in from a Canadian search plane; smoke signals had been sighted. At once a [illegible] rescue team was dispatched. Over the target [illegible] survival experts plummeted into space and chuted down to Thompson's men. Medical supplies, food, and other equipment followed.

Helicopter Aids in Rescue

Next day a helicopter began shuttling the men to a lake 12 miles away, where a pair of amphibians picked them up and flew them back to base.

What did all this prove? Not that Thompson or his men had become accomplished woodsmen. Matter of fact, they had made many mistakes or omissions, not the least of which was their inexcusable failure to [illegible] to set gill nets. The river they were about to embark on with their raft ran in the wrong direction; it would have taken them even farther from civilization.

But Thompson, whose indoctrination in survival had been limited to base-level training and a two-hour checkout at Goose Bay, knew that the essential principles can be quickly grasped and that their application can mean the difference between productive disaster and group collapse. He kept the morale and imagination of his crew focused upon purposeful, practical activity. He left no doubt where the leadership was vested, yet he made it plain, too, that the full cooperation of each was vital to the success of all.

With more training Thompson and his men could have done better. But they gave striking evidence of how far even a little knowledge can take a bunch of novices and of how much we can expect from the really well-schooled fliers we are now graduating each fortnight from Stead.

Other accounts in the National Geographic May issue of survival training [illegible] "Survival on a Pacific Atoll," by [illegible] Stead, January, 1948, and "The [illegible]

American Wild Flower Odyssey

A Lifetime's Search Covers Deserts, Mountains, and Lowlands; Prizes Range from Maine Orchids to Texas Cacti

By P. L. Ricker

President, The Wild Flower Preservation Society

With 28 Color Illustrations by the Author

DURING the past 60 years I have traveled some 150,000 miles to study and photograph wild flowers in almost all parts of the United States.

This lifelong interest in a form of Nature almost infinite in its beauty has taken me by boat, canoe, buckboard, automobile, train, and on foot to cold and storm-swept mountain summits, barren deserts, sinister swamps, lush meadows, and wood aisles.

In all these places, and many more, wild flowers display in season their amazing variety of color and form. All year round, through cycles of growth and rest, they demonstrate Nature's almost unbelievable adaptability to environment.

A fossil fern, displayed in a piece of rock on my Maine grandmother's parlor whatnot, first aroused my interest in Nature. As a small boy of 7, I was forbidden to touch it. No one could tell me about it, so I borrowed a book on fossil plants from the public library. It proved so fascinating that botany in general and wild flowers in particular have served me as a lifelong profession and hobby.

Flower Hunting Often Exciting

Tracking down a "lost" or elusive wild flower is as exciting to the botanist as a search for wary game is to a hunter.

A case in point is the box huckleberry. It was originally found in Virginia between 1800 and 1805 by three botanists, but after they died the locality was lost. In 1845 it was found in New Jersey. In 1921, more than 100 years after its Virginia locale was lost, the Reverend Fred W. Gray, an amateur botanist, observed the plant near Dorr, West Virginia, not far from the Virginia border. He learned that locally it was known as juniper berry, and in a few weeks, through newspaper advertising and correspondence, discovered more than 75 localities of the plant.

Later I searched for box huckleberry with friends along a stream between Annapolis and Baltimore, Maryland. Finally, after two days of hunting through thick stands of mountain laurel, we found it. The exact location must remain a secret, for the plant is much sought as a decorative shrub, and this small stand might be destroyed.

Another kind of adventure sometimes accompanies the search for wild flowers. Nearly 50 years ago a friend and I were studying plants and wild flowers in the Okefinokee Swamp in southeast Georgia. Poisonous water moccasins were so thick that our guide, wearing heavy knee-high boots, walked ahead, killing snakes with a machete.

Once, as we pulled our boat ashore, the guide reached toward a hole in a cypress stump. At the same moment I saw something move within the cavity. Quickly I emptied my revolver into the hole, and a fatally wounded moccasin slowly emerged.

Another time, while I was botanizing with friends in the woods of western Pennsylvania, a member of the party bent down to pluck a May apple. Suddenly he straightened up, yelled, and fled down the trail. A big rattlesnake was coiled completely around the stem of the flower!

When an angry bull objected to my photographing a large field of several kinds of wild flowers near Bozeman, Montana, I had to toss my camera hastily into a thicket and make for a handy tree.

In general, however, the pursuit of wild flowers is infinitely less dangerous to man than are man's activities to wild flowers.

As Nation Grows, Flowers Vanish

The spread of civilization across North America rapidly destroyed the flowers that once were abundant. Some species even may have become extinct. A century ago railroad surveyors and early settlers on the Great Plains reported vast stands of colorful wild flowers covering the land for miles. Today most of these species are rare.

Saving America's wild flowers from destruction and promoting enjoyment of their beauty are the principal objectives of the Wild Flower Preservation Society.*

To help inform travelers of the most interesting and colorful flowers to be found in

* Leaflets listing wild flowers that need protection are available, showing how to establish wild flower preserves and transplant flowers to preserves from areas that are to be cleared. Copies may be obtained by sending 20 cents in coin (not stamps) to the Wild Flower Preservation Society, 4540 Oliver Street, N. W., Washington 15, D. C.

[illegible] have come [illegible] the country during [illegible] and recent summers, both to see the flowers at [illegible] photographs.

200 Species Described

Space permits the [illegible] brief description of only about 200 of the 25,000 species of wild flowers native to the United States. Many of the [illegible] species would take more text space than is available in a magazine issue of the NATIONAL GEOGRAPHIC.

In this article I have [illegible] some of the more familiar flowering [illegible] of the more familiar flowering [illegible] shrubs. They are mentioned in a [illegible] to [illegible] and common names. Scientific names may be found readily by those who [illegible] desire in any [illegible] regional reference work on wild flowers.

To photograph wild flowers I use a [illegible] lens reflex camera and an exposure of about one tenth of a second at f/8 to f/24 [illegible] to show the natural colors and [illegible] of the flowers. Some photographers have good results in addition when using [illegible].

On [illegible] to Mount Rainier National Park in March, I [illegible] through the woods [illegible] on the side of Paradise Mountain [illegible] the day we were [illegible] by the dwarf cornel or bunchberry and [illegible] white bracts [illegible] the tiny, [illegible] purple or violet star flowers [illegible].

Near a special [illegible] of white fawn lily [illegible] called [illegible] flower [illegible]

Mount Desert Island, Maine, Start of the Wild-flower Odyssey

[illegible] [illegible] lies in the [illegible] [illegible] [illegible] makes a [illegible] [illegible] on the Mountain [illegible] Mount Desert Island's [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

White [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] to North Carolina and west to North Dakota. [illegible] [illegible] [illegible].

Bunchberry, or dwarf cornel flowers, [illegible] [illegible] [illegible] [illegible] [illegible] have the [illegible] of flowers but [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

Bunchberry, a member of the dogwood family, ranges from Newfoundland south to West Virginia and west to California and Alaska.

[illegible]

mixed woods and thickets from Vermont to North Carolina. Here and there, too, we saw the pink or white flowers of [illegible], so named because the [illegible] crest on the blossom, flanked by two wing-like petals, somewhat resembles a flying bird.

Around the [illegible] of [illegible] we saw a few of the magenta flowers of [illegible], a [illegible]-growing [illegible] [illegible] [illegible] blooms in May and June and ranges from Newfoundland and Quebec south to Pennsylvania.

A Plant That Catches Insects

[illegible] plants in a nearby bog were unusually [illegible] [illegible] (Plate [illegible], page [illegible]). The [illegible] pitcher-shaped leaves are partly filled with rain water [illegible] digestive material secreted by glands in the leaves.

Attracted by [illegible] [illegible] [illegible] the mouth, the plant's victims crawl down into the pitcher but are prevented from returning by stiff [illegible] hairs lining the [illegible]. They [illegible] into the liquid and drown, and the leaf absorbs the [illegible] of the softer parts of their bodies.

Insect food is believed to provide the plant with nitrogen which otherwise would be lacking in their nourishment.

Along the [illegible] shore of Mount Desert Island [illegible] search revealed the [illegible] [illegible] [illegible] handsome purple flowers. [illegible] [illegible] [illegible] [illegible] of beauty, [illegible] [illegible] [illegible] [illegible] with a [illegible] [illegible] [illegible] flowers.

Orchids are not associated [illegible] [illegible] with the State of Maine, yet these delicate flowers abound [illegible] the [illegible] [illegible] [illegible] [illegible] Caribou. I was [illegible] in an [illegible] [illegible] [illegible] the

Kodachrome by Leonard Lee Rue

Flowering Dogwood Brightens the Spring Landscape from Maine to Texas

For more than [illegible] the plain red autumn foliage. Virginia and South Carolina [illegible] State Flower; [illegible] Texas.

late Olaf O. Nylander, a Swedish naturalist. Mr. Nylander, then 80, and I had corresponded 50 years earlier, when I was a student [illegible]

Most [illegible] of all the orchids we found was the [illegible] round-leaved orchis, with its spikes of two to ten slightly [illegible] flowers about half an inch long and a white lip dotted with purple. Near its [illegible] grew [illegible] white [illegible] mouth and four species of [illegible] green and [illegible] orchids [illegible] wintergreen.

Arctic Plants on Mount Katahdin

In a bog and in damp woods near Fort Fairfield we found two species of twayblade, one with greenish-yellow and the other with brownish-purple flowers. The [illegible] "Jo Mountain" were the nicing place of the spotted coralroot, named for the [illegible] of its root to the shape of coral. We also found its yellowish-spotted relative.

It is a far cry from lowland orchids to the dwarfed and hardy alpine plants that survive the [illegible] and deep snows of Maine's [illegible] Mount Katahdin, which rears its granite cliffs abruptly above the nearly level surrounding country.

Here live plants that were [illegible] in their homes in the far North and have [illegible] to it this day in the harsh environment [illegible] over. They could not stand the summer heat and uncertain moisture supply of the lowlands but on the mountain they have plentiful water supplied by fog and rain.

The top of Katahdin was so cold that June day that even with two pairs of gloves my hands were almost too chilled to work the camera.

Near the summit is a [illegible] "[illegible]" with a dense growth of very dwarf [illegible] edged with thick mats of *Diapensia lapponica*, a small, thick-leaved heathlike plant with [illegible] small white flowers. [illegible] also found on the high mountains of New England, New York, and the alpine regions of Europe and Asia.

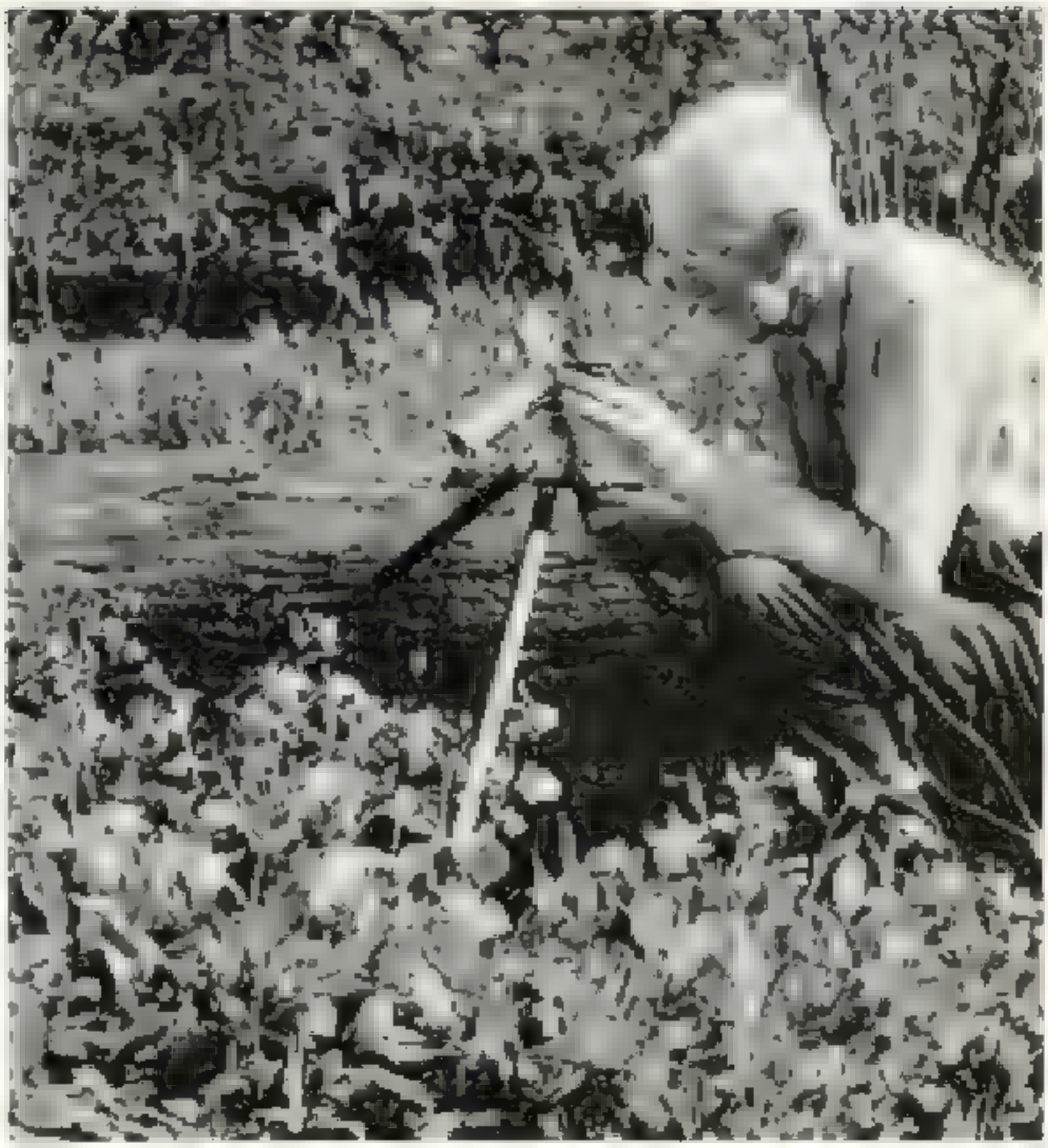
Below the edge of the tableland, in rocky nooks with a [illegible], we found alpine [illegible], with [illegible] and mountain heath, whose heathlike blooms are pink to purplish

Here, too, we discovered the last remnants of the blooms of Lapland rosebay, which had reached its peak two weeks before. This dwarfed alpine tree, growing near the ground to avoid the cold wind, bears rhododendron-like flowers. It grows in Greenland and Labrador, but in the United States only the high mountain summits of New England and New York know it.

Along the trail farther down grew a subalpine plant, Labrador tea, a low shrub with clusters of white flowers and evergreen leaves covered underneath with brownish woolly hairs. Indians in Canada have used it as a tea substitute.

Here we found good stands of sheep laurel, a low shrub with crimson-pink flower and elliptical leaves dark green above and pale green beneath. Commonly called lambkill, sheep laurel is sometimes called lambkill because animals often recover.

Driving from Mooselookmeguntic to Moosehead Lake, we frequently saw the white form of the pink lady's-slipper (page 600). Now and then a brood of young partridges scuttled into the underbrush while the mother sat in the middle of the road trying to lure us away until the chicks were out of sight.



Virginia Bluebell Ornaments the Nation's Capital

[illegible] Page 599 [illegible]

Hawkweeds Are Imported Pests

In open fields near Moosehead Lake were many acres of the beautiful but obnoxious orange and yellow hawkweeds, two of the worst weed pests of New England. The weeds are believed to have entered the United States mixed with grass seed from Europe, before the days of plant inspection.

The most important stops were the northern New Jersey Pine Barrens and the Long Island Hampton, long known as a botanists' paradise. We waded several hours [illegible] the cedars, the earliest [illegible] the color released when the plant [illegible] the flower is [illegible] and swamp [illegible]. The scent attracts carrion-eating flies which carry pollen from plant to plant.

Skunk-cabbage flowers are purplish brown, yellow or purple. Almost all the close relatives of this [illegible] are found in desert Mexico.

Interspersed among the cedars grew [illegible], with [illegible] clusters of scarlet [illegible] flowers [illegible] for the [illegible] spring.

Patches of little beetleweed, or flowering moss, spread like [illegible] the sandy soil of a [illegible] near Hampton.

Potomac Valley Wears Lady's-Slippers

In August, in the central [illegible] May, one may find two yellow-flowered orchids and in [illegible] yellow [illegible] the small, [illegible] with [illegible] of the showy orchid.

Pink lady's-slipper, or moccasin flower greeted us in profusion in the Potomac Valley of Maryland and Virginia. This, our largest and most beautiful northern [illegible] of

interest because of the way it forces honeybees to assist in its propagation.

Entering the flower, the bee enjoys a banquet of nectar spread for her, but when she is ready to leave she finds herself trapped. The only way of escape is through a narrow aperture where sharply pointed papillae comb out the pollen grains brought in by the bee on the hairs of her back or head. As the bee struggles on, anthers deposit fresh pollen upon her back, and this she eventually carries to the next flower, insuring reproduction of the species.

Pink lady's-slipper needs acid soil and will not live under ordinary garden conditions or if watered with chlorinated city water, which is too alkaline.

Trout lily (page 612) also blooms along the Potomac, in large yellow stands. Its name was bestowed by John Burroughs, the naturalist, who noted how the brown spots on its leaves resemble the fish's mottled coloring. The seeds develop a small bulb which produces only small leaves. Succeeding bulbs grow more deeply into the ground each year for seven years, producing flowers only at the end of that time. Then new seeds start the cycle again.

Many species of the wild flowers of this area may be seen in the 400-acre Conway Robinson Memorial Forest near Gainesville, Virginia.

Flower lovers of the Nation's Capital and near-by sections can enjoy a treat each year in the upper part of Rock Creek Park, where in April a large area is almost completely covered with trout lily, spring beauty, white trillium, toothwort, and blue and white and yellow violets (page 607). Many species of violets produce two forms of blossoms, one having the usual petals and the other the so-called "hidden" flowers near the roots.

Small colonies of trailing arbutus (page 610) also bloom in Rock Creek Park. Its fragrant white-pink flowers are harbingers of spring in many areas. The species is disappearing because it is hard to pick the blossoms without uprooting the plant. When it was found by the Pilgrims they called it Mayflower, from its time of blooming.

Skyline Drive Offers Bright Display

Southwest from Washington the Skyline Drive and Blue Ridge Parkway offer one of the finest displays of wild flowers in the eastern United States (page 618).

Early settlers in the Appalachian region burned large areas to provide pasture, and this practice and subsequent grazing by cattle largely destroyed the great stands of wild flowers which grew here originally. They survived only around the edges of pastures and in out-of-the-way places, but now that farmers have been moved from the park areas, wild flowers are making a strong comeback.

Here, without leaving the car, one may see pink azaleas, yellow lady's-slippers; viper's bugloss, introduced from Europe; wild pink; and bird's-foot violet. Many other species such as bog orchids and white buck bean, can be found only by searching bogs and adjoining fields and woodlands on a short hike from the road or the near-by Appalachian Trail.*

Redbud and flowering dogwood are at their best between mid-April and mid-May along this route. The "flowers" of dogwood are not the true blossoms, but supposedly are intended only to attract insects to the small yellowish-green real flowers at the center of the showy bracts (page 606).

Trilliums (page 611), whose white flowers turn pink with age, also bloom at about this time in the same area. The flowers are very sensitive to light and turn on their stalks to follow the sun across the sky. The young plants of trillium sometimes are eaten as greens under the name of "much-hunger," but the roots are highly emetic.

Cowslip Greens Are Edible

Big Meadows bog, between Panorama and Swift Run Gap, and other wet places along the road display quantities of yellow marsh marigold, or cowslip (page 615), also often eaten as greens. They should be boiled twice, however, as the fresh leaves contain a poison.

Flame azaleas, ranging in color from pale yellow to deep orange red, and the rosebay, or rhododendron, bloom pink to purplish pink from the last of May to the middle of June or later, higher up in the Virginia and North Carolina mountains.

Red columbine displays its inverted, cornucopia-shaped flowers in the fields throughout the season, and around the end of July it will have for company the Turk's-cap lily (page 613), with its yellow-and-red flowers, and five-foot stalks of black cohosh, which has white spires rising one to two feet from a base two or three inches thick.

In the spring, dry slopes having acid soil display spring iris (page 612) with its blue purple flowers resembling giant violets from a distance; and bird's-foot violet in two colors, the three lower petals lilac purple, the two upper petals dark violet.

No eastern State can surpass the wild-flower displays of North Carolina's coastal plain from spring to early fall. Driving from New Bern to Wilmington, four or five miles from

*See "Skyline Trail from Maine to Georgia," by Andrew H. Brown, NATIONAL GEOGRAPHIC MAGAZINE, August, 1949.

Pink Lady's-slipper, Lowlier, Northern Orchid, Forces Bees to Assist In Reproduction

[illegible] **Pink Lady's-slipper** [illegible]

Fragrant, Delicate Trailing Arbutus Shyly Proclaims Spring Is Here

Pilgrims named the giant Mayflower out of their [illegible] for the [illegible] it reminded them of home. [illegible] Massachusetts claims **Trailing Arbutus** as its state flower. Many [illegible]

Skunk Cabbage Rushes the Season, Sometimes Growing Out of Snow

Skunk Cabbage [illegible] Rock Creek Park, Washington, D. C. [illegible]

▲ **Passionflower Reminded Explorers of Christ's Crown of Thorns**

[illegible] Passionflowers [illegible] Spring.

▼ **Light-sensitive Trillium Turns Blossoms Toward the Sun**

[illegible] Trillium [illegible] to Virginia [illegible] North Carolina. [illegible]

◂ Spring Iris's Purple Blooms Spread a Violet Scent

[illegible] **Spring Iris**, [illegible] Florida [illegible] Mississippi [illegible] Lake [illegible] Virginia.

▾ Trout Lily Takes Its Name from Mottled Leaves

[illegible] **Trout Lily** [illegible] Michigan.

^ Marsh Marigold Spreads Golden Carpets in Swamps and Meadows

[illegible] **Marsh Marigold** [illegible]

^ Red Columbine's Inverted Blossoms Resemble Cornucopias

[illegible] **Turk's-cap Lily** [illegible]

Seaside Indian Paintbrush, or Painted Cup, Lives Only on Rocky Cliffs Along California's Northern Coast

Brilliant flowers of Castilleja latifolia have grown in the coastal sands for [illegible] years. Seaside Indian Paintbrush is parasitic on the roots of grasses and possibly other plants. Most species have red flowers, but this one is [illegible]

[illegible] **Common Lupine** [illegible]

[illegible] **Sierra Shooting Star** [illegible] **Marsh Marigold,** [illegible] **Coast Trillium** [illegible]

* **Globe Mallow Brings Vivid Color to the West's Dry, Sandy Plains**

[illegible] **Globe Mallow's** [illegible] Western [illegible]

* **Lewisia Montana's State Flower, Honors a Western Explorer**

[illegible] **Bitterroot**, [illegible] **White Clover**, [illegible]

the ocean, we saw white Spanish bayonet occasionally growing in roadside fields.

Most interesting of the plants of this area is the Venus's-flytrap (page 629), a carnivorous plant found only in this region. It blooms about Memorial Day. The plant is difficult to keep alive in cultivation because it gets fewer insects than in the wild and because soil conditions usually are unfavorable.

Leaves at ground level around the base form the trap. When an insect alights or crawls upon a leaf, it touches one or more of three sensitive trigger hairs on each side of the leaf's midrib. This touch sends a stimulus to the midrib, causing the two halves of the leaf to close.

Stiff, hairlike bristles on the edges of the leaf interlock so that the victim cannot escape. Meanwhile the insect is covered with digestive juice excreted by the leaf when the trigger hairs are touched.

Sundew Fluid Fatal to Insects

Three species of another carnivorous type, the pitcher plants, also are common in this area. Two of them, one with red and the other with yellow flowers, bloom about Memorial Day, and a third, also having red flowers, about a week later.

Roadside ditches and low, damp areas near by treeed with sundew (page 629) still another carnivorous plant. Its leaves are covered with sensitive reddish hairs which exude drops of sweet, sticky fluid. Insects attracted by the sweetness are trapped in it. As they struggle to escape, the hairs are stimulated to give off more fluid and bend over to trap the victims.

Other flowers that brighten the coastal North Carolina landscape include hairpins, so named because of the shape of their flower stalks; white-topped sedge; violet, white, and yellow butterworts; and orange milkwort.

Along woodland borders we saw occasional loblolly-bay trees with large white flowers, resembling the famous "lost" Franklinia tree, named for Benjamin Franklin, which has not been found growing wild since 1790 and is believed to have been destroyed by fire and men seeking specimens for sale. Cultivated specimens still survive, however.

Shrubby honeycups, with long racemes of large, white huckleberrylike flowers, are so common that they comprise 40 percent of the flora in the 48,000-acre Holly refuge near Bargaw, North Carolina. Often we saw fields and roadsides covered with the spicy, fragrant white to purplish dwarf azalea. Yellow jessamine, State flower of South Carolina, formed solid masses of color on trees and fences.

Solitary, erect scarlet flowers of the Catesby lily, spotted with yellow, were conspicuous though not common. Near the road we often spotted the two- to three-inch purple-and flesh-colored passionflower (page 611). Its basal corona and fringelike filaments are supposed to represent Christ's crown of thorns, and the nail-like pistils the nails driven into His hands and feet on the Cross. The five sepals and five petals supposedly are symbolic of the 10 faithful disciples, excluding Judas, who betrayed Him, and Peter, who denied Him.

In sandy fields we saw many beds of the blue common lupine (page 615), also known as sundial because its leaves rotate up to 90° to follow the sun. Often mixed with it was the beautiful rose-red *Phlox drummondi* introduced here from Texas.

One of the best flame-azalea displays may be found the last half of June on Mount Mitchell, in western North Carolina, the highest peak east of the Rockies.

Here also are large stands of galax, the leaves of which are much used by florists for wreaths and other decorations. It was here in a storm during a surveying trip in 1857, that Elisha Mitchell, the geologist and botanist for whom the mountain was named, fell into a stream and was drowned.

Rosebay Covers Roan Mountain's Top

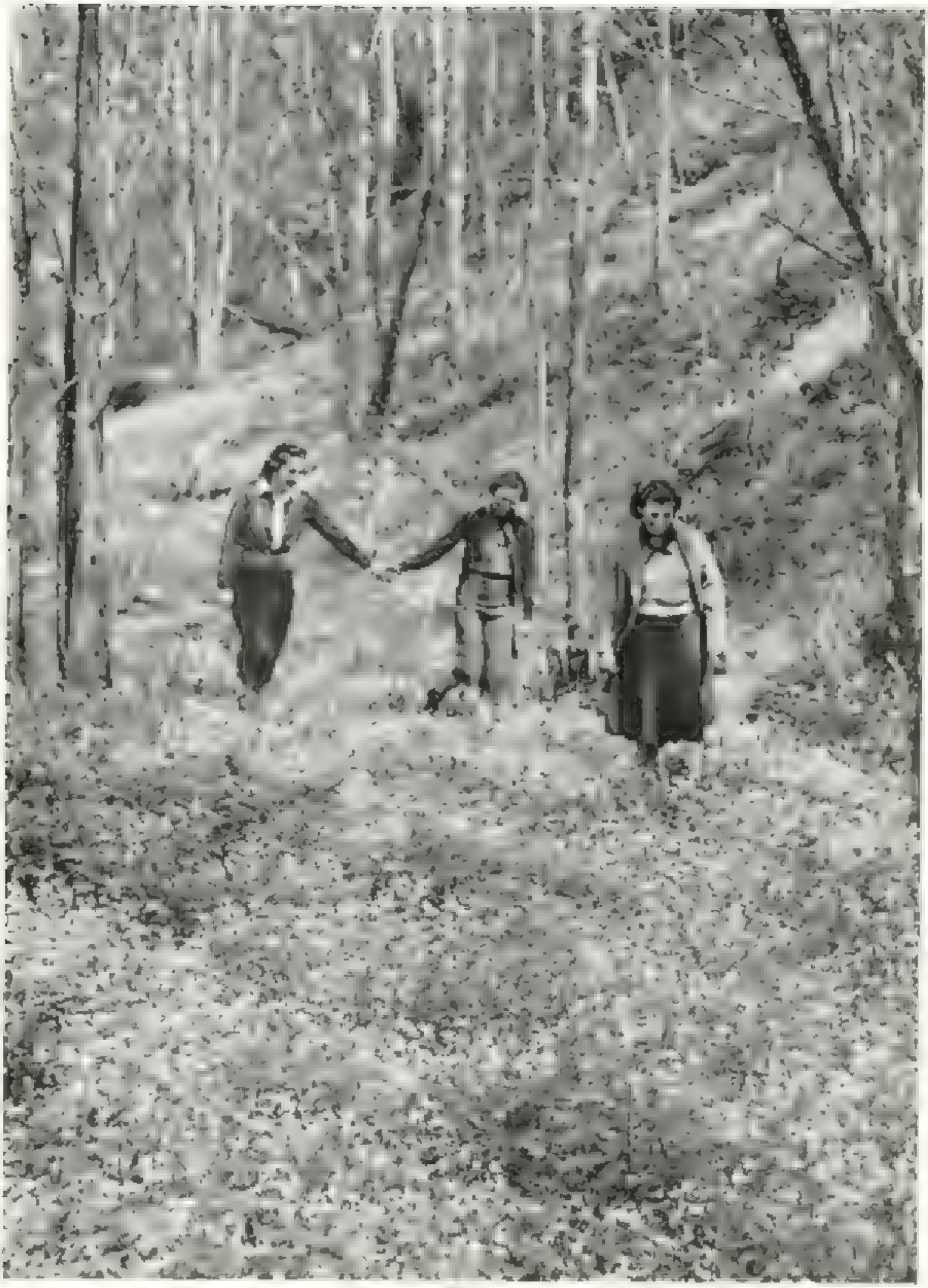
The thrill of a lifetime awaited us at the end of June on the lonely summit of Roan Mountain, on the North Carolina-Tennessee border, reached by a dirt road from Bakersville, N. C. The higher of the mountain's two peaks has two large masses of rose-pink mountain rosebay, covering 400 to 600 acres, the most gorgeous display of wild flowers we saw in the entire Southeast. A fire tower on the lower peak provides a fine view of the blooms. Elsewhere this flower is rose purple.

Clingmans Dome, in the Great Smoky Mountains, with an automobile road nearly to the summit, offers one of the best views of the area. Pink rhododendron and white to pinkish mountain laurel, which bloom in this region in June and early July, can be seen on the peaks known as the Chimneys from the lower road, but near views of the best areas can be obtained only by a strenuous trail trip of several miles.*

During World War II, when supplies of [illegible] were [illegible] of both rhododendron and laurel were used for making pipe bowls, and still are.

Mountain laurel is one of the most abundant plants all the way from the Berkshires of western Massachusetts to Florida. Some farmers consider it a weed and try to burn it out, but even forest fires do not kill it

* See "A Trip Through the Smokies," by [illegible] Hart, NATIONAL GEOGRAPHIC MAGAZINE, [illegible] 1952



Spring and Its Wild-flower Beauty Lure All the World to the Woodlands

[illegible]

Bright-yellow Flowers of Rabbit Brush Shimmer in the Mojave Desert

Rabbit [illegible] loves plains and stream [illegible] Some species contain [illegible] used as a [illegible] The specimen of this type [illegible]

Hundreds of tons of its leaves are used annually as decorations, but even this practice does not threaten its existence.

Laurel stamens bend backward until the pollen ripens. Then, as part of the pollination cycle, the stamens will forward like [illegible] feet onto neighboring flowers.

[illegible] flowers [illegible] early in March, [illegible] species in each 100 miles of driving, most of them just getting started. Among them [illegible] dwarf flag pawpaw, with one-and-a-half-[illegible] wild petunia.

Along the Tamiami Trail through the Everglades we found it worth while to drive slowly and stop often, though some flowers cannot be seen without walking in the swamp [illegible] near the road. Most beautiful of southern plant pests, the bluish-purple water hyacinth fills the canal in many places on the north side of the highway (page 621). A constant eradication program must be maintained to prevent [illegible] trees.

[illegible] the [illegible] plant [illegible] nourishment [illegible]

Also on the [illegible] bark is found the small flowered green [illegible] orchid. I succeeded in [illegible] of bark [illegible] glass of water.

Along roadsides near Tampa we saw [illegible] milkweed with odd white-veined leaves, a small purple sesban tree, and a low

Black-eyed Susan Carpets a Field with Gold

[illegible] Maryland's State [illegible] This stand sprang up in Lewis Spring Valley near Baltimore

[illegible] with three-petaled [illegible] fragrant white flowers, also called [illegible] because it [illegible] extremely peasant to have [illegible]

A few miles west of Durham, north of [illegible] are occasional fields of yellow-headed [illegible] plant [illegible]

Often in the Southwest [illegible] the two to three-inch flowers of [illegible] white with a purplish tint [illegible]

Louisiana Leads in Iris Species

Louisiana greeted us in April with its many species of iris, far more than can be found in any other State. A few may be seen at Lake Avery Island Bird Sanctuary south of New Iberia.

Unfortunately, many of the iris species have been lost forever through filling for levees and the draining of swamps. Countless thousands have been dug up for gardens, where in many cases they failed to survive.

Texans can boast that probably close to 40 percent of their wild flowers, except for introduced weeds, are found in no other State. The first such native, or endemic, species we saw was the famous State flower, the Texas bluebonnet, *Lupinus subcarnosus*, which so closely resembles our more common *Lupinus texensis*, also called bluebonnet, that few people know the difference.

An old legend says that the red spots on Texas bluebonnet petals represent blood spilled from an Aztec human sacrifice.

Approaching the San Antonio area we found most of the bluebonnets growing with Indian paintbrush, but about 60 miles to the northwest, near Kerrville, was a solid field of bluebonnets covering several acres (page 634).

Along the road from Hearne to Mountain Home were nutty pink mimosa, yellow wild flax, a low white-flowered yuccalike plant called lunch grass, or sacfoiste, and white rain lily, which lies dormant until a rain and then comes up thickly.

In east Texas we also saw several flowers common throughout southeastern and northern plains areas, including false dandelion, false [illegible], and wine cups with one- to two-inch red purple blossoms.

On the high, arid plains of west Texas vegetation is marvelously different but even in dry years mesquite, creosote bush (named for its odor), sotol, and several species of cactus bring forth their flowers. Other plants lie dormant until, every three to seven years, there is sufficient rainfall; then the plains flame with color.

Two common flowers we saw were Indian blanket, or fire wheel, with a wide red inner zone and a narrow outer ring of yellow, and the rosy pink gaillardia (page 632).

The Texas Highway Department at Austin

furnishes advance information about the [illegible] flowering season and [illegible] planting program. On the approaches to bridges and culverts several large species of Spanish bayonet have been set out. One of these, *Yucca treculeana*, is often ten to twelve feet tall and displays clusters of large white flowers from three to five feet long and two or more feet in diameter.

We had the good luck to find in the Davis Mountains the only native American species of yellow-flowered wild onion, *Allium cepa*, which is used in only a few localities there.

Mexicans Make Cactus Salad

Beyond, on the plains, were yellow buttercups, [illegible] to livestock and so abundant that it greatly restricts the value of other plants organizing.

Cacti in this region are [illegible] to [illegible] them all, but one of the most common is prickly pear (page 630), from which the Mexicans make candied and candy after removing the spines. One of the varieties, grown in Mexico as tuna, has an edible fruit resembling strawberries in taste and color when ripe.

Most prickly pears have large yellow or white flowers that often take on a pinkish hue with age. The joints have many long spines and small rosettes of short, barbed spines.

Cactus spines, often found here, have [illegible] jewel [illegible] around them but luck the flowers are small, pink, [illegible] space [illegible]. In some species known as chollas the joints are so loosely attached that they drop off at a mere touch, as I learned when some of the barbed spines stuck in my back while I was taking a picture [illegible].

Hedgehog cacti are low, cylindrical, single-stemmed plants, sometimes forming spiny hemispherical mounds. The flowers are usually [illegible], orange, or scarlet [illegible] near the [illegible].

Water Hyacinth, a Lovely Pest Hinders Boating in Florida

This [illegible] plant, [illegible] can be [illegible] but [illegible] carried [illegible] and [illegible] reduced [illegible].

Barrel or fishhook cactus, similar to the hedgehog but larger, has stiff scarlet or bright yellow [illegible] flowers. The plant looks [illegible] somewhat coarsely fluted or furrowed and has rosettes of spines along the [illegible]. Fruits vary from yellow to red. Twenty-second travelers sometimes cut off the top of the "barrel" and drink the liquid secreted in the whitish pulp.

Nopal cactus (page 631) is a favorite source, noted for its good nutritive value. Used in general [illegible] and the presence of Nature prevents excessive loss of moisture by transpiration in the [illegible].

As we approached the Chisos Mountains which rise with unexpected rugged grandeur in the southern part of Big Bend National Park, the first change from the desert flora that we noticed was Texas madroño, a small tree member of the heath family with thick

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Snow-white Matilija Poppies Beautify Southern California's Coast

[illegible]

Giant Cactus Bears Corrugated Arms Aloft. Jumping Cactus Seems to Throw Its Spines

[illegible]

glossy, rounded leaves and [illegible] white buckthornlike flowers.

At a pass leading into the Chisos Mountain basin stand a huge rock some 500 feet [illegible] [illegible] plant.

Century's Spikes Used as Weapons

Century plants are so named because they are slow to mature and blossom, although most species bloom in about 20 or 30 years [illegible] Margins of the leaves are white, gray, and [illegible] long, sharp spikes on [illegible] were used as weapons by the Indians. The flowering stalk, with a [illegible] yellow flowers [illegible] a height of 30 feet.

Mexicans make pulque, which is [illegible] liquor, from the fermented juice of century plants and distill the mescal [illegible] to produce potent tequila.

[illegible] branching type [illegible] Another section of [illegible] was lined with a solid [illegible] [illegible] here, where [illegible] enough moisture for the seeds to germinate.

After several hundred miles of desert driving we had a longing for green vegetation and satisfied it with a trip up 10,713-foot Mount Graham, in Arizona, where snow still remained near the top. Water from the melting snow had brought to life small white Rocky Mountain marsh marigolds.

A [illegible] looking white [illegible] Christmas decorations [illegible] the banks of Fran-

mann's spruce. Like its eastern relative, this mistletoe has rootlets which penetrate the bark and absorb sap but apparently do little harm to the tree.

A violet haze covering the ground near Globe, Arizona, proved to be a large growth of very small gilia, suitable for cultivation in rock gardens. Farther along the roadside the leguminous paloverde tree, which bears its seeds in pods, was a solid mass of golden flowers. During the dry season these trees are leafless, but they remain conspicuous because of their yellowish green bark.

Wild-flower lovers visiting this area should not miss the Boyce Thompson Southwest Arboretum near Superior, Arizona, where several hundred plants native to this region are brought together. Here grows yellow-flowered incienso, which yields a gum formerly chewed by the Indians and used as an incense in churches.

Tall, whiplike, thorny stems of the ocotillo, ends closely covered with bright-red flowers, were often seen on rugged slopes and roadsides beyond the arboretum. Its leaves fall off in dry weather but grow out again after a rain.

Tall Saguaro Useful to Birds

Farther down the slopes were many giant saguaros, which produce the State flower of Arizona and often reach a height of 50 feet. The upper half of this cactus has several erect arms, crowned by conspicuous white rings of flowers. Woodpeckers drill holes in the saguaro for nests, which later are taken over by elf owls. Birds feed on the pulp.*

Two-inch wide white flowers of Easter daisy, which bloom around Easter time, greeted us at Grand Canyon National Park. On the Dripping Spring Trail in the canyon itself we saw a low pink phlox, often grown in rock gardens; red-bracted Indian paintbrush and a red-flowered beardtongue.

As we crossed from Arizona into Utah, the roadsides [illegible] with white-flowered desert [illegible] Oregon grape. [illegible] Oregon State flower, and its blue [illegible] clusters.

Sparse desert vegetation through Utah and Nevada was punctuated by gray sagebrush and 15- to 30-foot Joshua trees, the only yucca which has many short branches.

California greeted us with desert willow, not really a willow at all, for it thrives on little moisture and for this reason is much used for windbreaks in the Dust Bowl area farther east. Sand verbena, another desert flower, displayed rose-purple blooms.

Along the edge of the Mojave Desert, at Victorville, California, we found in an oasis, formed by runoff from irrigation water, a large stand of one- to two-foot yerba mansa with small white flowers on a conical spike, surrounded by five to eight white leafy bracts.

Cajon Pass, 3,823 feet high, brought us the finest display of wild flowers we had seen west of Texas. Most striking were the many quixote plants, more aptly called candles-of-our-Lord, for the stalks stand up exactly like candles in a candelabrum.

Santa Barbara Garden Covers State

Santa Barbara's fine Botanic Garden provided in two days a better view of California wild flowers than could be obtained in weeks of travel. The plants are set out in typical habitats, such as arroyo, canyon, chaparral, desert, foothill, forest, island, meadow, and woodland. Here we saw yellow bladderpod, yellow giant coreopsis; white Apache plume, so named because its seeds bear tiny plumes that enable them to sail on the wind; white matilija poppy (page 622); yellow bush poppy, and yellow Fremontia, or flannelbush, named for the famous explorer of the West, John C. Frémont, who discovered it in 1846.

We also saw gum plant, whose fluid extract is good for poison ivy, but, strangely enough, often works only once for any individual.

The State flower, California poppy, once was plentiful in coastal valleys and foothills. Accounts of sailors and others who visited the San Francisco Bay area in the days before California was settled tell that the hills around the bay were solid with California poppy. Spaniards called it *copa de oro*, or "cup of gold." Now it is seldom found abundantly except in inaccessible spots.

Some of the country around Bakersfield only a few years ago also had beautiful displays of wild flowers. Since then, however, 5,000 acres have been plowed for planting grain.

Crossing 2,224-foot San Marcos Pass beyond Santa Barbara, we were rewarded by finding cinison sage; chaparral, a name applied to thickets of rigid or thorny shrubs on dry mountain slopes; chamise, with close panicles of small white flowers; and red heart, so called because the upper sides of the branches become reddish brown in drying.

Sheets of gorgeous color greeted us along the coastal highway that parallels the Pacific. Lower slopes of the Coast Ranges were covered with solid masses of blue and white lupine. Toward Lucia the blue lupine is replaced by yellow in a similar display (page 620).

Beyond Carmel were brilliant orange-red displays of seaside Indian paintbrush, or painted cup (page 614), and one of the

*See "Saguaro, Cactus Camel of Arizona," by Forrest Shreve, NATIONAL GEOGRAPHIC MAGAZINE December, 1945.

Insect-consuming Pitcher Plant Drowns Its Prey in Rain Water

[illegible] **Pitcher Plant** [illegible] Bernard P. Marmorat

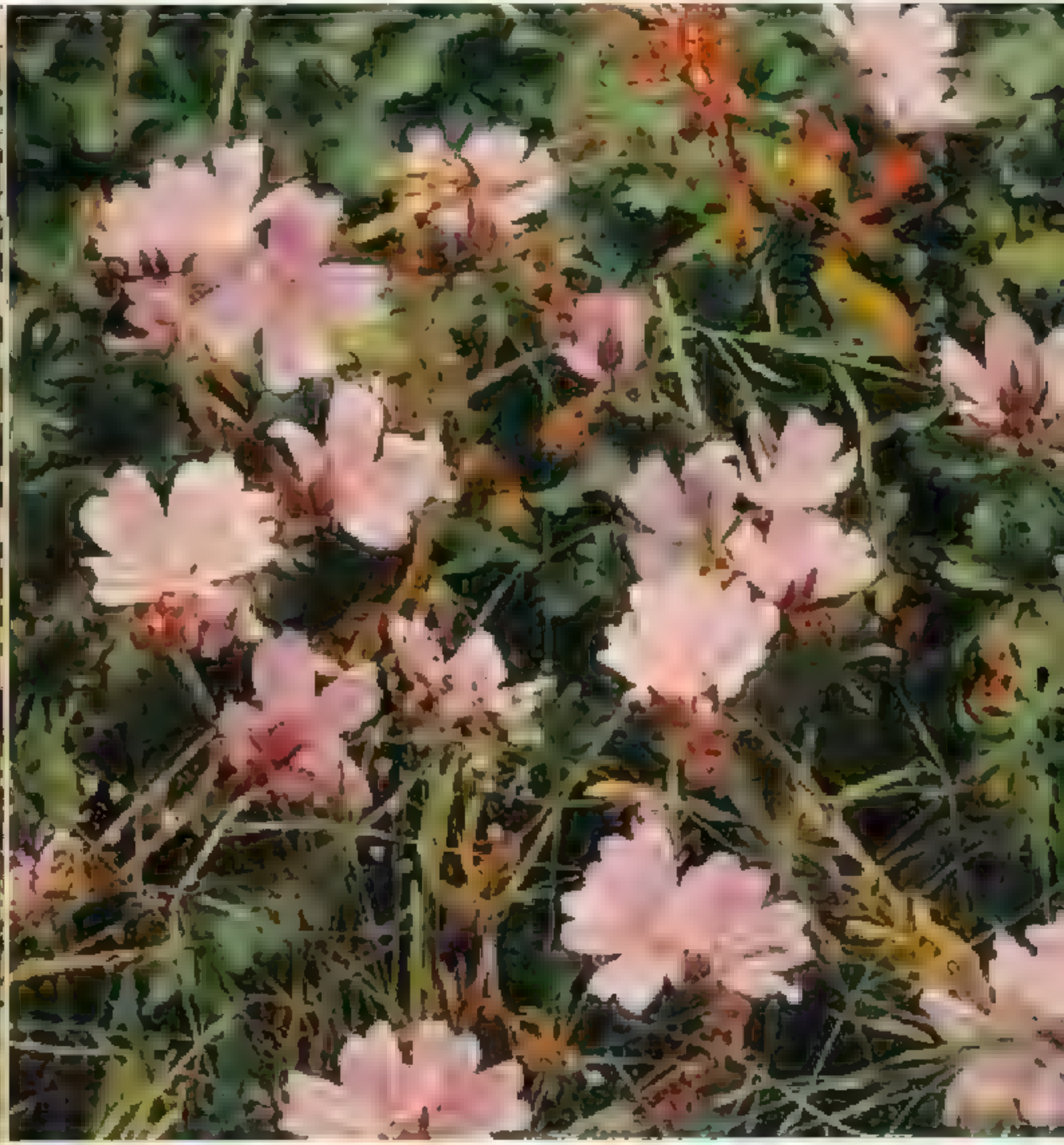
Lupines Carpet the Pacific Shore with Gold: Little River Beach State Park Near Petrolia, California

Western Centaur's Flowers Hug the Ground

[illegible] the **Western Centaur** [illegible] This [illegible] the [illegible] of California.

Checkerbloom Colors California Hillsides

From Tomes State Park [illegible] the [illegible] of [illegible], the **Checkerbloom.**



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Carnivorous Hooded Pitcher Plants, Posed Like Cobras, Await Their Prey Near Lake Fern, Florida

Such insects, trapped and drowned in a fluid within the tubes, are digested by the **Hooded Pitcher Plant** in [illegible]. Certain species live only in the plant's liquid, which does form [illegible] of the trap. Native to Southeastern United States, from North Carolina to Lake [illegible].

Venus's-flytrap (Right) and Sundew Set Efficient Snares to Catch Insect Food

Fringed with stiff bristles, the trap-like leaves of *Dionaea muscipula* stand cocked, open, awaiting prey. If an insect touches one or more sensitive trigger hairs on the leaf surface, the halves snap shut; the bristles interlock to prevent escape. Sometimes **Venus's-flytrap** catches [illegible]. This plant grows near [illegible], North Carolina.

◄ Sweet sticky droplets, shining like dew, attract insects to the leaves of *Drosera intermedia*, the **Sundew**. Stimulated by captured insects, the plant's hairs bend to secrete more fluid, suffocating its victim. An acid then digests the softer parts. Beltsville, Maryland, raised this potted [illegible].

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Kodachromes by [illegible]

Cane Cactus Guards Flowers with Sharp Barbs

[illegible] **Cane Cactus** [illegible] Texas [illegible] Mexico, Central America, and New Mexico.

Yellowish Nipple Cactus Is a Prickly Dwarf

[illegible] and Texas [illegible] **Nipple Cactus** [illegible] the desert.

Prickly Pear [illegible] 1511 [illegible] Mexico [illegible] Rio Grande [illegible]

A

Tidytips Are Nearly Ringed with Immaculate White Edges

Tidytips [illegible] Texas [illegible] Plains Bluebonnet. Texas [illegible] [illegible] Tidytips [illegible] [illegible] *Layia platyglossa* [illegible] the Lone Star State.

Y

Goldeye Phlox Is Found Only on Texas' High Prairies

Phlox [illegible] flower [illegible] the Lone Star State. [illegible] **Goldeye Phlox** [illegible] [illegible] the state. [illegible] [illegible] the [illegible] [illegible]

beardtongues. There are more than 250 species of this attractive plant, the beardtongue, all native to North America except for a single Japanese species.

A strange example of Nature's adaptability can be seen at Point Lobos State Park. Here is the country's last sizable stand of Monterey cypress. Growing on its branches are long strands of a green alga supposed to have been blown there from the sea several hundred thousand years ago and to have adapted itself to growing out of water. It is festooned like Spanish moss and now draws nourishment from air instead of water.

Rich Display at Point Lobos

The flower display at Point Lobos exceeded in color anything else we saw on our odyssey. Included in it were a lavender mallow called checkerbloom (page 627), a rose-pink gentian called canchalagua, purple owl's-clover, a yellow composite known as lizard's-tail, and sulphur-yellow tidytips (opposite), all [illegible] mingled with seaside Indian paintbrush. California has more than 1,000 species of wild flowers not found in any other State.*

Yosemite National Park displayed large bushes of white western azalea and yellow pond lily. In the garden near the park museum were Stiver's lupine, with yellow banner and pink wings; wild geranium; and white to pinkish pussy's-paws, whose flowers suggest the feet of a cat.

Western flowering dogwood grew along the drive to Glacier Point, with five white bracts instead of the four of the eastern species. Higher up, a mountain meadow was covered with small white coast marsh marigold, while in the background was a stand of white fir, its trunks covered solely with a small, branching yellow lichen which was once used by the Indians for dyeing clothing and blankets.

Along the road in pine woods we saw the bright-red snow plant, a relative of the Indian pipe, which sometimes grows near the edge of melting snow and is saprophytic—that is, it feeds on decaying vegetation. It first appears above ground as a large inverted cup-shaped bud and gradually develops a thick, scaly red stem up to 15 inches high, the upper half bearing fleshy red flowers.

A wild flower nursery above Columbia displayed thousands of trout lilies raised from bulbs which mature in two years instead of the seven required by the eastern species.

Near Myers the ground was covered with an attractive small white flower called western centaur (page 627). Its small blossoms and habit of growing close to the ground make it appear much like the eastern trailing arbutus. Farther on, near Lake Tahoe, were many camas lilies with racemes of small dark-blue flowers. Just north of Ukiah we saw many summer's darlings with one- to two-inch rose-pink flowers and a central blotch of a deeper shade on each petal.

Firecracker plant, well named for its cluster of tubular bright-red flowers about an inch long, was seen at Richardson Grove on the scenic Redwood Highway.

Covering the landscape at Little River State Park was yellow lupine. On the sandy approaches to the beach were large areas of a trailing yellow sand verbena.

Large stands of pink coastal rosebay, or rhododendron, State flower of Washington, were blooming at Del Norte Coast Redwoods State Park, and near by grew a rose-red corn, or lead, lily. Near the coast at Smith River, [illegible] phacelia, and baby blue-eyes.

Azaleas Blaze in Oregon Park

Azalea State Park, just across the California line in Oregon, has a fine display of white to creamy western azalea and occasional bushes of honeysuckle bearing [illegible] small black fruits surrounded by conspicuous red bracts.

A few miles west of Cave Junction, Oregon, we were guided to a mountain bog filled with western pitcher plants, with one- to two-foot slender hooded pitchers and one-and-a-half- to two-inch pendulous dark-purple narrow petals.

Topping a 2,600-foot ridge to catch our first view of snow-capped Mount Hood, we saw three- to four-foot stalks of bear, or scouring, grass, bearing conical racemes of small white flowers six to twelve inches long. In a boggy area at the base of Mount Hood were growing many plants of western skunk cabbage, which has two- to three-inch bright-yellow spathes enclosing the inner fleshy body that bears small flowers.

Several feet of snow were still banked behind Timberline Lodge, 6,000 feet up on the slopes of Mount Hood. Below it the banks of a small stream fed by the melting snow were covered with coast marsh marigold, white coast trillium, and a purple shooting star (page 615).

Near Olympia, Washington, at Hawks Prairie, we found lupine, bellflower, Oregon sunshine—a composite with yellow flowers—and two-foot stalks of death camas, so named because its roots contain a deadly poison.

Near Vantage, Washington, where we crossed the Columbia River, we saw blazing star, with its two- to three-inch yellow flowers, and sulphur flower.

* See, in the NATIONAL GEOGRAPHIC MAGAZINE "California Says It with Wild Flowers," by Frances Woodworth, April, 1942; and "Wild Flowers of the West," by Edith S. Clements, May, [illegible]

634 [illegible]

Sehorgels Flight on a Sea of Bluebonnets the Texas State Flower

In [illegible], Texas roadsides and pastures turn a gorgeous purple with stands of [illegible] of Sunday motorists drive out to see them. Artists have [illegible]

Flowers of Yellowstone National Park are [illegible] and a well [illegible] per [illegible] a gold brooch. For I will remember [illegible] larger [illegible] yellow [illegible] ly, [illegible] the last obscurely named for the curved upper lip of the red to purple flowers [illegible]

The drive eastward from Yellowstone Park to Beartooth Lake and over the 10,947-foot Beartooth Pass to Red Lodge, Montana, not [illegible] the most scenic area of the Northwest but offers a fine variety of wild flowers. They include larkspur; arnica, whose European relative provides the extract used in the medicine of the same name; and, at the top of the pass, Marinosa [illegible] and [illegible] marigold, the last often en- [illegible]

The [illegible] *Lewisia rediviva*, the state flower of Montana, grows in this region [illegible]. Its [illegible] name honors Meriwether Lewis of the Lewis and Clark Expedition. Bitterroot is found from Montana's Bitterroot Range, named for it, westward and south to Arizona. The Indians once roasted the starchy taproot for food.

Southward from Yellowstone Park few wild flowers appear on the arid plains, but occasionally we [illegible] with slender red [illegible] flowers are [illegible] one and a half inches long, [illegible] globe mallow, which prefer [illegible]

Finest of Wyoming's wild flower [illegible] were in the high meadows of the Medicine Bow Mountains west of Laramie. Here and [illegible] we saw a wonderful subalpine garden with hundreds of Rocky Mountain [illegible] marigolds and crimson-purple primrose. Nearby were white sandwort, purplish [illegible] ly, rose-purple heads of alpine clover [illegible] brated Indian paintbrush, trout lily [illegible] fleabane, bluebell, and bog laurel.

Crossing 11,797-foot [illegible] Pass [illegible] west of Denver, we photographed large [illegible] of yellow alpine sunflower [illegible] *fremontii*, a small form with terminal clusters of [illegible] white flowers.

Wild flowers furnish beauty everywhere. Some of the loveliest grow in harsh deserts or on the chill summits of barren mountains. Wherever seen, they reflect the glory and wonder of Nature unspoiled.

For other articles on wild flowers of the United States, see [illegible] Magazine Cumulative Index, 1899-1952.

The GI and the Kids of Korea

America's Fighting Men Share Their Food, Clothing, and Shelter with Children of a War-torn Land

By Robert H. Mosier

Technical Sergeant, United States Marine Corps

I'M NOT PROUD when I'm asleep at a battalion command post; they're usually a good 1,000 yards back of the front line. But when the machine-gun slugs began whining over our tent, I woke up.

From the tinny cough of the gun I figured it was a light Russian type, like a Browning. From the angle of the shots I decided the North Koreans who had lugged it through our lines must have set it up near our mortars and were shooting across our gulch, the bullets ricocheting off the boulders at our back. With no moon to see by, they were just spraying the neighborhood in general.

Our riflemen up on the hill opened up about then, and a fairly brisk fire fight got under way. I rolled over, shoved my head under my sleeping bag, and tried to go back to sleep. There were a lot of green replacements in the area that week, and anybody who got up and wandered about after dark was as likely to get clipped by our side as by the enemy.

But after a while, in spite of all the racket outside, I could hear somebody shuffling around in our tent. I thought it might be Sgt. Roy Dunnan, the new photographer just assigned to the 3d Battalion, 1st Marine Division, so I said,

"Listen, don't get all shook up. This sort of thing goes on all the time."

He didn't answer, though. In a moment a match scratched, and I saw by the candle he was holding that it was Kim, my houseboy. His pack was at his feet, and he'd been loading it with all his most precious possessions—his album of pin-ups, a tattered old Christmas card from my wife, a carton of cigarettes, and stuff like that.

Too Much for a 15-year-old

"Where d'ya think you're taking off for?" I asked him.

He looked at me, and his lip was trembling a little. "Movie," he said. "They show movie back at photo lab."

I glanced at my watch. "Looks like you've missed the beginning of it already," I said. "It's 2 a.m."

I'll say this for Kim: It was the one and only time I ever saw him scared. He was 15 years old; this was the second winter of the war, and he'd taken plenty. I used to get a lock watching him walk around under counter-battery fire, as cool as a field ration, while recruits from stateside were diving for the ditches.

I first met Kim at a refugee camp near Changjo-ri. It was snowing, and I was standing by a sentry fire talking with some of the men. Kim came out of a tent near by. He stood there quietly until there was a lull in the conversation, and then he put a question through one of the Korean guards: "Could I be your houseboy?"

It was pitch dark, but in the light of the flames I was surprised to see the kid was neat as a pin. Even his shoes were shined. It had been so long since I'd seen any youngster who wasn't dirty, ragged, and generally beat-up that it gave me a jolt.

Kim Finds a Father

I checked into Kim's record. He came from a Korean Christian family that lived in Hoengchon. His father had been killed and his home bombed out, and he had wandered up toward the front in search of work or food or both. He'd been pushed around a good deal, but he wore a grin that looked as if it were stuck on to stay (page 639).

I adopted Kim. Or perhaps it was the other way around. At any rate, we took care of each other. I gave him tent space and part of my rations and whatever odd bits of clothing and gear I could scrounge. In return, he policed our quarters, washed my clothes, and guarded my belongings when I was out on jobs as a photographer assigned to division headquarters. Occasionally he cooked me Korean dishes.

Kim spoke no English at first, and I no Korean; but we learned fast. He carried a pad with him everywhere, pulled me up short on any word he didn't recognize, and made me write it down. He didn't have to be told anything twice.

American food didn't sit too well with Kim for a while. In a few weeks, however, he developed a passion for what he called "No.-1 chow"—spaghetti, ice cream by the quart, steak, and candy from my rations.

His liking for American things went further. He plastered his part of the tent with color pictures cut from American magazines. He talked my arm off about American trade schools, never quite getting over his surprise at the idea of youngsters being trained free.

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Gift and Gift Span the Language Barrier Between U. S. Marine and Korean Orphan

[illegible]

[illegible]

Airlifted from the Fighting Zone, These Anxious Orphans Expected Marines to Eat Them

When Marine Aircraft Group 12 learned that a band of [illegible]. When [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

He had to be pulled bodily out of a hot shower. He saw every movie that came to our area and became convinced that all Americans either rode horses or drove Cadillacs, held up banks as a matter of course and peppered each other with six-guns on the street.

It was inevitable, I guess, considering my job, that Kim should develop into a "shutterbug." I got him a simple camera, salvaged some slightly fogged movie film, and taught him to load the cartridges inside his sleeping bag. He was so excited he would rush to the tent door, shoot 16 exposures in 16 seconds, and return for more.

To Hongchon for Christmas

When he calmed down and learned something about composition and lighting, he did pretty well. In fact, he often outshot our official photographers, because he could coax his fellow Koreans into more natural-looking poses than any [illegible] Yank could achieve.

Kim wasn't particularly homesick, but as the Christmas season rolled around he began to get itchy feet. So I decided to surprise his family and take him back to Hongchon for the holidays.

This meant presents, of course. Not electric trains or neckties or perfumes or cigars—they don't have department stores along the front. It meant [illegible] around the quartermaster section, where Marines going home on rotation discarded their surplus [illegible]. It meant [illegible] some friends out of a set of long johns and a [illegible] jacket. It meant saving up my PX ration of chewing gum and chocolate.

Finally, though, we had our sleeping bags loaded with loot, I got a pass, and we started hitchhiking south [illegible]. A Marine [illegible] [illegible] [illegible] [illegible] line. Then we thumbed an Army supply truck heading for an engineer camp.

Snow was drifting down as usual and trucks had churned the roads into [illegible]. But

The Kid Who Walks Alone: War's Little Old Man Ascends the Ramp to a Rescue Plane

[illegible]

the rounded mountains looked as serene as ever. I heard Kim muttering something, and, when I asked him to translate, he quoted me some lines that went about like this:

> [illegible] house I want
> [illegible]
> The best and farthest is the road of my desire
> Often at dusk their voices call me
> [illegible]
> And I see flows down to me from deep far [illegible]

For most of the five-hour trip through the hills and battered villages Kim concentrated on the harmonica we had sent him for Christmas. He was trying to play the Marine Corps song. He made a hash of it, but he kept trying.

It was dark when we pulled into the courtyard of Kim's home. After the [illegible] house in Hongchon proper had been demolished, they had moved into a farm building 14 miles northeast of the city. I could spot the dull gleam of a candle; otherwise the place looked dead.

It came to life with a bang when Kim flung open the door and called that we were here. More people boiled out of the house than I had thought were in the whole village.

While his sister and the servants danced around him, and everyone [illegible] Kim's mother took his face in her hands and stared at him as if she wanted to memorize every line in it. She hadn't seen him for six months, and I guess she had wondered whether she ever would again.

639 Tokyo Robert H. M[illegible]

Kim, the Author's Friend, Wears an Indelible Grin

Infatuated with all things American, Kim [illegible] steaks, cowboy movies, pin-ups, hot showers and [illegible]. Able to cut in fellow Korean into natural poses, he [illegible] shots not pictures superior to Marines' official photos. Here he practices with Sergeant Mosier's old camera (page 645).

I was introduced as Kim's [illegible], a cross between Santa Claus and Sergeant Lincoln. My arms ended in [illegible] and I stood there feeling like a freak and wondering if I should have brought them for Kim's grandfather instead. [illegible] and shook hands.

A Party To Be Remembered

That broke the ice a bit. Kim's good-looking sister popped out with [illegible] drinks. His grandmother cleared a place for us on the rice mat, and a servant rushed off to get us drink and some food (page 657).

It was pretty overwhelming. If they thought we were little [illegible] when we first arrived empty-handed, they were ready to elect us senator and president respectively when we unzipped in our sleeping bags and unloaded our pre-[illegible].

I've never been backstage at a musical comedy on Christmas Eve, but this was a bit like [illegible] laughing, pulling at one another and exchanging [illegible] presents [illegible] personally hitting the hill.

The gift on the mother-to-be, packed around five rude ass [illegible] was Sergeant Mosier's own shirt. Kim [illegible] a Marine [illegible] jacket with USMC on the left pocket. I came [illegible] to his knees. His grandfather, whitebearded and dignified in his [illegible] fatigue cap he accepted. But nobody cared.

As the party picked up speed, more and more villagers kept trickling in. The kids romped through the sort of rummage sale we had set in motion. The old gentlemen squatted [illegible] the wall, puffing on their little bamboo-stemmed pipes. Since few of the Marines I knew smoked pipes, I had been able to get hold of a good many tins of tobacco from the PX, and now I doled them out.

When all the clothes had been passed

through, we produced American magazines. In two minutes the grownups were playing cut-it-out and-paste it up. The men went for the pictures of chromium-covered cars, complicated farm machinery, and bathing beauties. The women gawked at the automatic electronic gadgets in the spotless, fancy kitchens.

Both men and women were bowled over by photographs in color of Iowa cornfields and plains of Montana wheat. Korea is so hilly that if you set a marble down anywhere in it, I don't think it would stop rolling till it plunked into the sea. The sight of those vast flat spaces in America was, in a way, more impressive to Kim's folks than any shots I could have shown them of factories or cities or stacks of dollar bills.

A picture that especially appealed to the women showed an American man wheeling a baby carriage with one hand and carrying with the other a big bag of groceries, while his wife pranced along beside him holding nothing heavier than her purse. The female chatter over this revolutionary scene came to a dead stop when Kim's grandfather (the big boss, as in any Korean household) strode over and asked what all the fuss was about. The women turned the page, quickly.

The party broke up about midnight. Neighbors and family members drifted away until only Kim and I were left to occupy the living room. We stretched out our sleeping bags and turned in, our heads pillowed on rice bags.

Sleeping on Stove-heated Beds

The stone floor slabs, heated from beneath by the exhaust from the sunken cookstove had been so hot earlier in the evening that I had had to requisition a cushion to insulate the seat of my pants. Now they had cooled to a pleasant warmth.

As I dropped off to sleep I could hear some of the village kids still singing. The words were Korean, but I recognized the tune. It was "Silent Night."

When I woke around 8:30, I found my dungarees had been not only washed but starched and pressed to a knife edge. What's more, Kim's mother, noticing that my trouser cuffs drooped over my boots and picked up the mud, had inserted elastic bands to make them fit snugly and dry.

Kim's sister brought us a pan of hot water, and, after we had washed, a bowl of rice. My first efforts with chopsticks landed a big wad of rice in the lap of the grandfather. She thought it was the funniest thing she had seen [illegible] since she was [illegible] and sat under the little low table they dined from.

I had trouble with another Korean custom, too. It was easy enough for Kim's folks to slip off their soft shoes when they entered the house. It was another thing for me to unlace my big boots every time I came in and to lace them up when I left, particularly when the grownups kept calling me inside to talk and the kids yelled to me to come out and play.

They gave me a good time, though. I felt almost as choked up as Kim when we had to say good by and hitch our way back to the front lines. Kim's grandfather made a little speech about how grateful they were, and all that. I'm not going to repeat it, but I haven't forgotten it; it was the kind of thing you wouldn't mind having for an epitaph, if you have to have an epitaph.

I thought about that matter of gratitude as we rode north. The Koreans I'd met had been really surprised at the kindness our troops showed toward their kids. Not that they don't like their own children, but their sympathy tends to dwindle at the limit of the family circle.

Reds Stoned Hungry Children

Moreover, they said they'd seen the Chinese Red soldiers either ignore or shy rocks at youngsters who tried to beg food from their company messes, and they expected our men would act the same way.

My work as a photographer had taken me around a good section of the forward areas, with Marine infantry regiments, tank and weapons companies, and rocket teams, Korean Marine units, and Navy medical sections. I'd seen what the Marines had done for Korea's kids, and I'd heard or read about the work of the other services. I guess they weren't doing anything that GIs haven't done in any country they've fought in; but, all the same, it made me feel pretty good to be an American.

A lieutenant with the 11th Marines—Harry L. Gary—took one look at the grease-pimpled ragged kids around his base and wrote home to Springfield, Missouri. Inside of 12 days his aunt and uncle and the local newspaper had put on a clothing drive and begun shipment of about three-quarters of a ton of [illegible], gloves, and things like that.

A fellow with the 1st Marine Aircraft Wing, M/Sgt. John Cain, began to chip in part of his pay to send some Korean kids to school. When Cain was shot down over North Korea the rest of his squadron took over the job. Now they have 20 kids in school and are trying to build a new one to house 100 more.

The wing as a whole didn't do so badly, either. By the time I left Korea, it had collected more than 100,000 pounds of clothing from home and had passed it along to some 2,000 orphans and hundreds of refugees (page

An Elderly Carrier Faces Korea's Future with Faith and a Strong Back

[illegible]

[illegible]

War's Steam Roller, Which Flattened So Many Korean Towns, Left Sokchori Untouched Beneath the Taebaek Range

The east coast village near the 38th Parallel [illegible]

These Grave Eyes Have Looked Upon Three Years of War

[illegible]

[illegible]

< The [illegible] who [illegible] Marines [illegible]

> The [illegible] Sunday [illegible] Marine [illegible]

[illegible]

644

Chinchon Residents Salvage the Foundations of Tomorrow's City from Wars Dusty Rubble

[illegible] United Nations [illegible] it to May [illegible] 1951. The woman's [illegible] [illegible]

Outdoor Oven Floods an Entire House with Central Heating

[illegible]

[illegible]

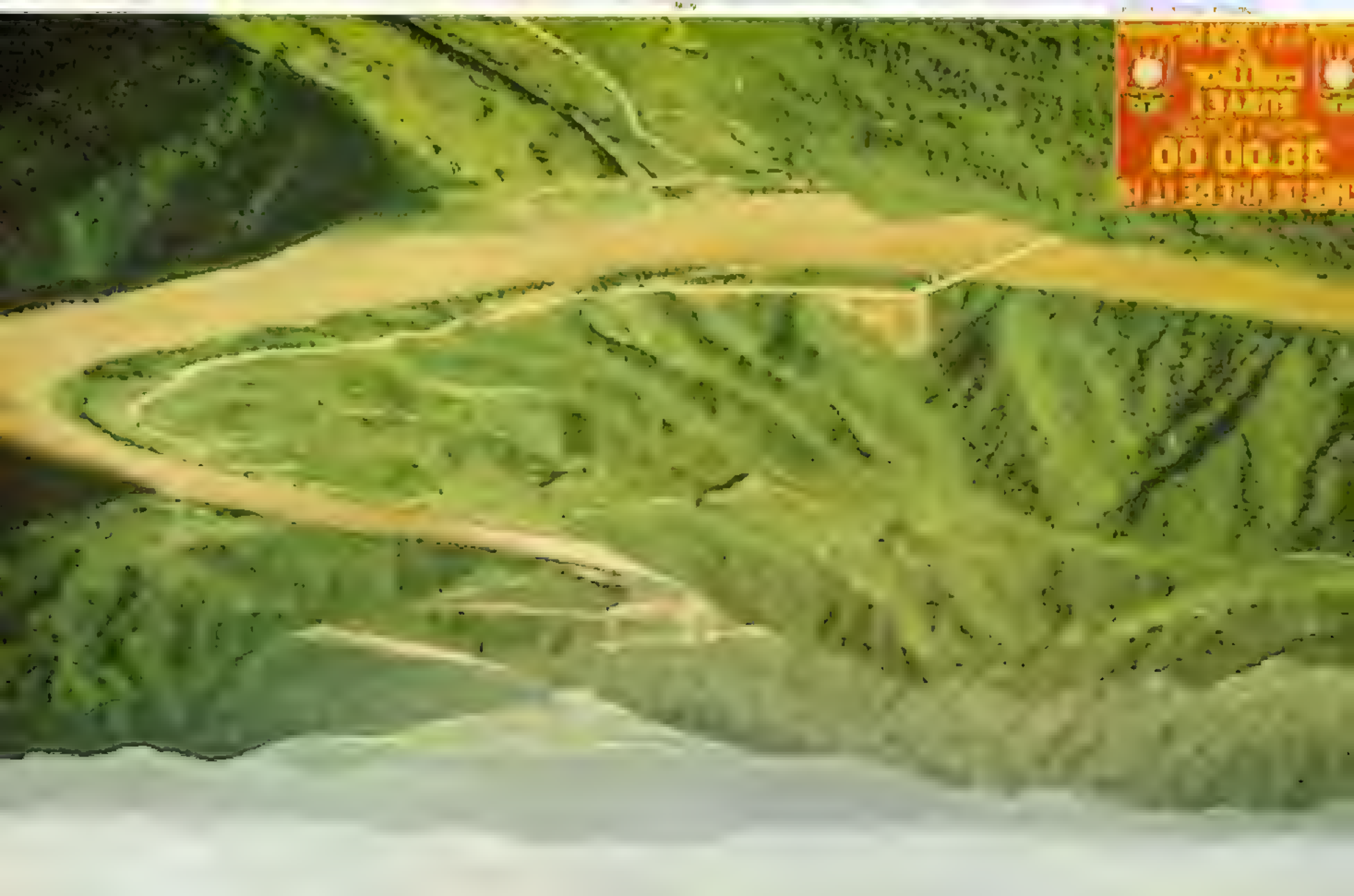
[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



The 38th Parallel; Where North Korea Meets the South

[illegible]

Puklan River Goes Across Water

[illegible]

Four Hundred Pounds of Flour Move by Korean Chief Burden Bearer: Man

[illegible]

Young Cowboys, Just off the Korean Range, Relax with Roy Rogers

[illegible]

[illegible] Up top of that, [illegible] from [illegible] and [illegible] [illegible]

Marines [illegible] Communist [illegible] There were [illegible] on the [illegible] Marine [illegible] [illegible] Korean [illegible] when the men heard [illegible] of Korean children stranded [illegible] no [illegible] land.

The U.N. civil assistance people were trying to evacuate them [illegible] truck but, in the snow [illegible] mountains the trip was taking [illegible] 12 hours [illegible] the children were [illegible] the way.

The [illegible] was that the Marines [illegible] a [illegible] transport up there. [illegible] half-starved kids so that [illegible] their [illegible] them to make [illegible]

When the plane landed at Kangnung, the kids didn't want to get out, and when the Marines sat them down in front of some [illegible] [illegible] the Communists that the Americans [illegible] round up children, fatten them, and dine off them.

Marine's Mustache Helps Cause

MAG 12 [illegible] convinced the youngsters that the Marines were more interested in [illegible] than [illegible] food. [illegible] they began to gobble up their food [illegible] and [illegible] with the [illegible] wooden horses the Marines had [illegible] for them.

But the group didn't let it [illegible] presence of good will. The Marine [illegible] on the support of the orphanage to which [illegible] [illegible] for clothes [illegible]

Korean Hopes For Peace Rest on Eisenhower

[illegible]

[illegible]

[illegible]

[illegible]

money (one Marine auctioned off in the States a picture of his 13-inch mustache), and even spent their few hours of leave time playing mursemaid, teacher, and back-scrubber. Two weeks later they went back to the front for another pitched ind

This idea of seeing the job through is pretty well illustrated, I think, by Lt. Comdr. Dick Cleaves, who was chaplain of Marine Aircraft Group 33. When Cleaves helped to set up the Marine Memorial Orphanage at Pohang dong, he took part of the money the Marines contributed and bought land which the kids themselves could cultivate. Kids were added only as fast as rice paddies could be bought. The orphanage consists now of six buildings and more than 5,700 pyong of rice lands (a pyong is 36 square feet).

These few instances, of course, don't begin to cover all that the Marines have done, formally or informally, for the children they've met. And the other services have been just as active. You might not think the Navy got ashore enough to know what the kids' needs were, but I can tell you what the men of one ship did, anyway.

They were serving on the carrier USS *Kearsarge*, and they decided that the children they wanted to help would be those who had had it roughest. So they picked out an orphanage set up in an old Buddhist retreat near Seoul, a place where soldiers brought kids abandoned along the battle line. For this little mission, run by American medical missionaries, they collected more than 1,200 pounds of warm winter gear.

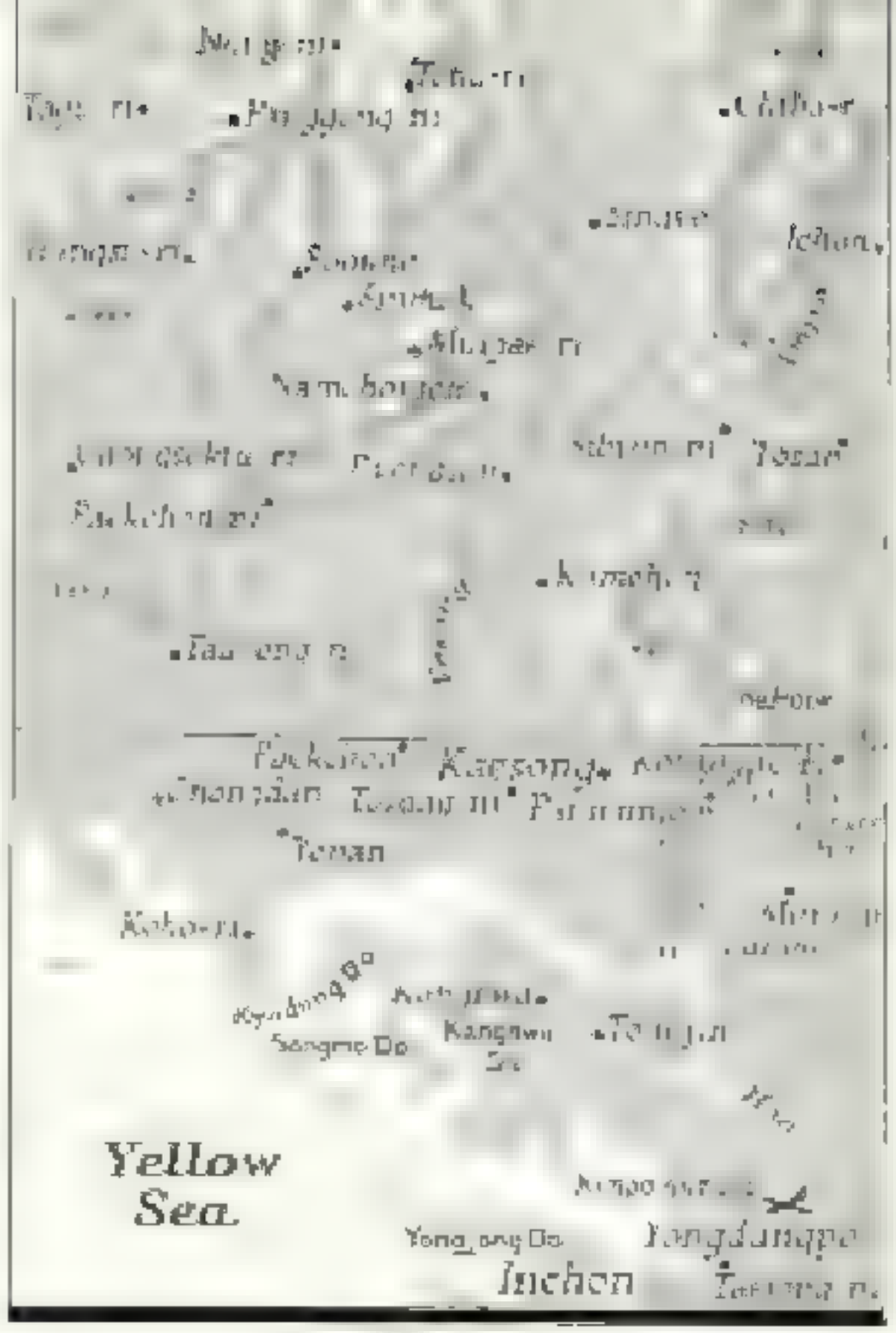
Navy units tend to pass the word along from ship to ship. Another one that did a real job was the heavy cruiser USS *Los Angeles*. Its crew rounded up big donations of cash and clothing for 10 different orphanages and hospitals in Korea.

I wasn't in Korea at the time of the Air Force's "Operation Orphan Annie," but I've heard about it. It was organized in December, 1950, when the Chinese were pushing us back, and it looked as if Seoul would have to be evacuated.

In the retreat we had picked up hundreds of babies—some of them sitting beside their dead parents, others just lost and huddled in the doorways of bombed buildings or sleeping on piles of rubble (page 641). Plans were made to ship them [illegible] to a safe island by a South Korean naval vessel.

But the ship never showed up at Inchon. So the Air Force Combat Cargo Command stepped in. Though they had work enough to do in the scramble that was going on to regroup all UN forces, they somehow rustled up 15 twin-engined transports, crowded 70 kids into each flight, and flew them southward out of Kimpo Airfield (page 638).

It was lucky they did; at least 100 of the



children were already too sick or weak to walk. The weather was freezing, and some of them had no more on than the straw sacks or thin rags they had been found in.

Airmen Return with Christmas Gifts

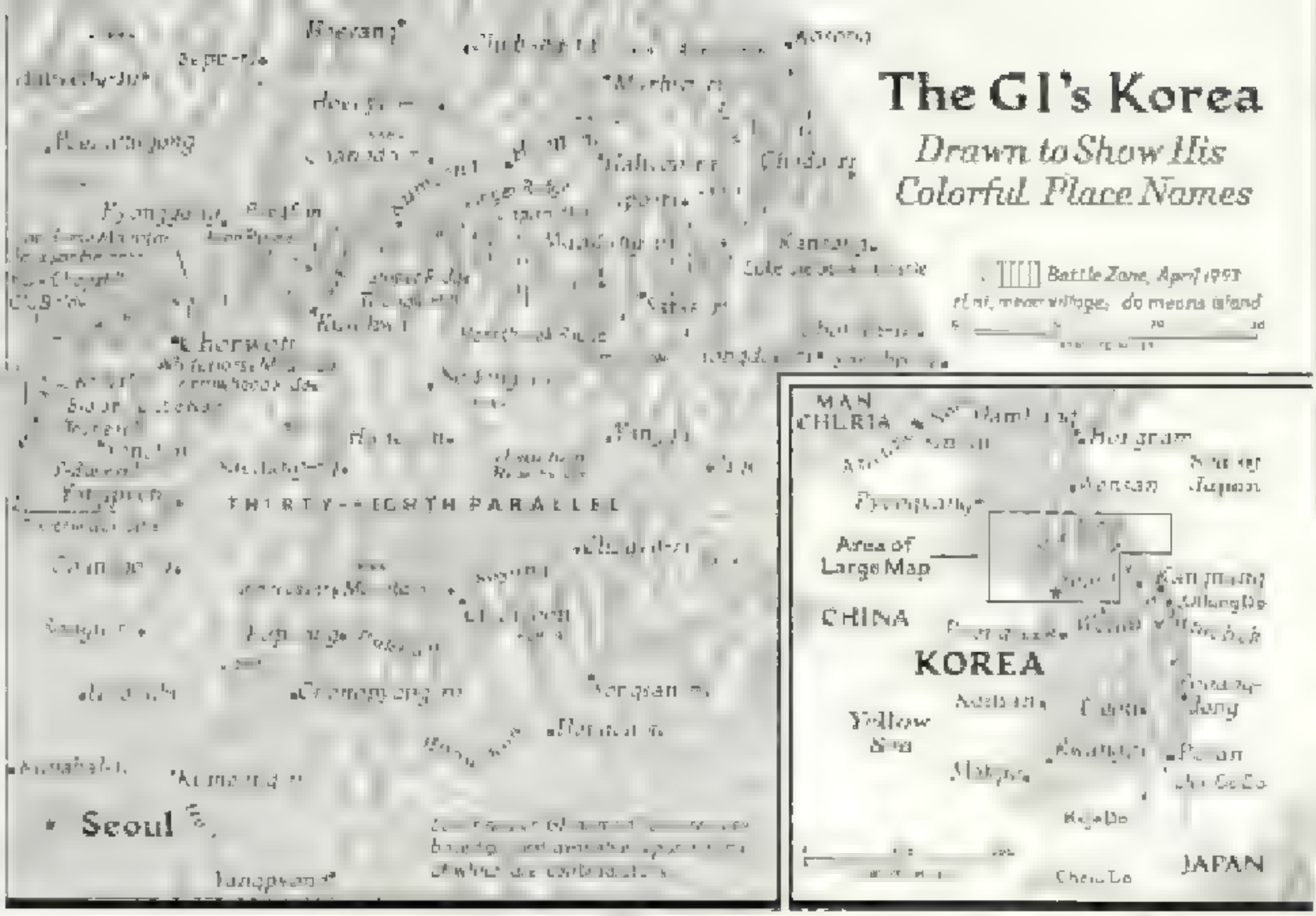
They arrived safely, though, and began life all over again on Cheju Do (Island). One thing that interested me was to read in the paper later that the airmen who had flown them in came back the following Christmas with a load (which they had paid for) of 1,000 lollypops, several Christmas trees, 1,000 rice bowls, 2,500 notebooks, 100 toothbrushes, and some sewing machines for the girls. Korea's "Orphan Annies" hadn't been forgotten.

What about the Army? All I can say is that whenever I picked up one of their newssheets in the field (anything from a blurry mimeographed regimental bulletin to a printed division weekly), I ran across accounts of clothing drives, fund-raising campaigns, building projects, and Christmas parties for Korean kids. (But the time items like that would crowd world news or battle stories right off the front page.

I remember particularly the job the 40th Infantry Division did at Kapyong, 36 miles northeast of Seoul. This little town wasn't exactly a cultural metropolis, I guess, even before the war. But when the fighting had whipsawed through it five times, it really be-

The GI's Korea

Drawn to Show His Colorful Place Names



Orphan-making War Has Ebbed and Flowed Across Korea's Central 38th Parallel

gan to show signs of wear and tear. Most of the houses, in fact, and all of the schools had been thoroughly chewed up.

That hadn't stopped the Korean teachers and their kids. They used tents for classrooms. With winter coming on, however, they were facing some pretty chilly school days.

At that point the 40th Division stepped into the picture. Its commander, Maj. Gen. Joseph P. Cleland, conferred with Kapyong's officials about their needs. Then he went back to his own men and put it up to them.

Within three weeks the GIs in the 40th scraped up $14,000—and an architect. He was First Lt. Robert F. Van Hoef, and he designed a long, low, modern school building which could take care of 600 kids. He even drew sketches of an auditorium and outdoor pool that could be added later.

That may sound fantastically ambitious. But $14,000 can go a long way in Korea, especially if the labor is free. The people of Kapyong, short on money but long on energy, volunteered to perform all the manual labor and to provide the sand, stone, and gravel. They even set up a little sawmill.

The work wasn't all left to the men, either. They have Widows' Clubs in Korea, made up of women whose husbands were killed in the war. The local Kapyong chapter turned out, 150 strong, and unloaded the stone for the rock-and-cement foundation.

When the building went up, the townspeople had one last request. They wanted to christen it. And the name they picked for it was Kaiser—for Sgt. First Class Kenneth Kaiser, Jr., of Los Angeles. Why? Because he was the first man from the 40th to be killed in combat in Korea.

"Boys' Town" Comes to Korea

There's another project you ought to know about. That's the Children's Democratic Town on Chin Do Do, off South Korea. It was set up by Lt. Col. John C. Keele [illegible] United Nations Civil Assistance Command Korea, in the spring of 1951, when UNCACK was getting worried about the gangs of [illegible] roaming the streets of Pusan, begging and stealing for their living.

Keele was interested in doing more for the kids than filling their stomachs—though that was a job in itself. He wanted to show them what democracy was all about, by having them live it.

The island he took them to was just a barren rib in the sea, so unimportant that nobody had ever bothered to name it. But the children did. They called it Chin Do Do, which means "Island of True Friends."

Under Keele's guidance, the town's 190 boys and 30 girls organized themselves into a community run on the honor system. Each month they elect their own mayor [illegible]

S 125 Refugee Families Work the Rice Fields in a U N Camp Near Manaus — Tarpaulins and Thatch Roof Tent Give Them

and departmental officials. Each tent has a judge, and the island as a whole has a high judge. Twenty boys make up the police force.

They had a rough go of it at first. Their tents were unheated; their blankets were spread on beds of seaweed. Clothes were scarce and rations uncertain. Now these kids are trying to become more self-sufficient by growing truck gardens, raising poultry, and fishing.

They wouldn't have pulled through, however, without relief packages, and they've shown their recognition of it by naming their tents after the cities from which the gifts have come. Streets in Cheju Do form a kind of roster of UN charity—Washington, New York, Sydney, Bangkok, Jerusalem, London, Manila, Paris. . .

Furthermore, the kids don't lose sight of the principles on which their town is supposed to be run. The lane up from the dock is studded with placards that read: "Absolute Honesty. Absolute Purity. Absolute Unselfishness. Absolute Love. No Hatred. No Fear. No Covetousness. New Man. New Country. New World."

A Big Drop in a Big Bucket

Quite an order. But the kids seem to think they can pull it off. At any rate, they've strung up a bell made of six shell casings. They call it the "Holy Bell of Change," and the inscription reads: "This bell changes everything. Things evil good; things good better. . . ."

These were hopeful things to mull over, jolting through the mountains on the long road back to the front. I knew we Americans were doing a lot, one way or another, to relieve the misery around us. Yet it still seemed a drop in the bucket. A big drop; but a big bucket, too.

The figures we usually heard put the number of Korean refugees at 3,500,000, the number of orphans at 100,000—this in a nation [illegible] 20,000,000. If [illegible] the same ratio of disaster to our own population of 158,000,000, it would mean more than 27,000,000 Americans blasted out of their homes and turned into the roads with not much more than a rucksack to their backs. Moreover, it would mean that those hordes of refugees would be pressing back upon cities and farms never really rich and now thoroughly ripped up by war.

Stacked up against calamity on a scale like that, our best efforts can't look like much. And I couldn't help wondering what will happen to Korea's children when the Marines and the GIs and the other troops pull out—a day that will have to come sometime.

It came for me in July of last summer. Our division was ordered to Munsan, and the commanding general passed the word down that all Korean civilians not essential to military operations would have to retire to the rear areas. That meant Kim, among others.

Kim could have returned to the refugee camp where I had found him. But it had no school, and we both agreed that school was what he needed most. So I fixed him up with some money, clothes, odd bits of gear, and candy, and put him in charge of a friend in the motor-transport pool who would drop him off at Hongchon. We said good-by.

As it turned out, I could have saved my breath, because Kim was back in a week. He said he was sticking with me for good.

"What about the general's order?" I inquired.

"You take me to general. I explain him."

I wasn't exactly on those terms with the general at the time, so I told Kim he would really have to go home. He cried. I came fairly close to it myself.

In the end, though, he went, clutching a three-cell flashlight and a watch which I couldn't help giving him. But he wasn't looking at the presents as he left. He was looking at me. Sitting up in the cab of the truck, he suddenly seemed very small and very young.

I never heard from Kim again. I didn't give him any forwarding address, and I didn't write him. He had his own life to take up again, among his own people, and I figured it would only sidetrack him to keep alive his hopes—the hopes almost any Korean kid has—of coming to America and living in the marvelous steel-and-chromium world of the illustrated magazines.

This Much Will Remain

Will Kim remember me? Will the Korean people in general remember the GIs whose job it was to break and smash and burn things, but who tried to mend what they could and to blot the tears off at least a few grimy cheeks?

When all is said and done, I think the Korean children won't forget us in a hurry. I came across a letter, once, written by the children of an orphanage near Inchon to the crew of the USS *Los Angeles*. It says, in its own odd way, what I believe a lot of Koreans would like to say:

"This civil war have made plenty of poor orphans who are lost their parents and warm cradel, they were wandered on the cold street during cold winter night, but now this orphanage fortunately have men like you who are very kind helper in the world especially UN force. We have feeling very thankful day and night."

Prisoner Women Grind Corn by Hand Near Hongchon

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

↑ A Marine Tank Digs In on a Frozen North Korean Ridge for Direct Fire into the Enemy's Positions

[illegible] Company, 1st Marine Division, [illegible] on patrol [illegible] Korean [illegible] tank treads from slipping. [illegible] Soldiers will lay sandbags [illegible] or mounting [illegible] their positions. [illegible]

▼ Soldiers graze [illegible] Most [illegible] there were [illegible] tanks [illegible] for photos. (page 148)

Long Poles at Right for the Morning Scrub at Hwachon

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Churchen Children Seek Security in a Bank's Tumbled Blocks of Granite

Marines Resting from Combat Hear the Songs of Home

[illegible]

Napalm Swathes an Enemy Bunker in Liquid Fire

[illegible]

Wear or No Wear, Man and Beast Must Go On Tilling Korea's Rice Fields

[illegible]

India's Sculptured Temple Caves

By Volkmar Wentzel

National Geographic Society Staff Photographer

With Illustrations from Photographs by the Author

AJANTA, India, is the most sensational priceless art heritage handed down to India." And Kailasa Temple at Ellora, the oldest Hindu monument of ancient India, is man's idea of a god's heaven.

Such descriptions, read as I traveled to India, helped to prepare me for an assignment by the National Geographic Society to photograph those extraordinary shrines in the State of Hyderabad. Months later, gazing upon carvings and frescoes, I understood why Ajanta and Ellora had evoked such praise.

Both religious centers were carved with infinite patience from the living rock. Monks, priests, and laymen worked by sun and torchlight for more than a thousand years on 60-odd temples and halls.

Frescoes Picture Ancient Life

Ajanta monastery was settled two centuries before the Christian Era, when followers of Gautama Buddha retired to that lonely precipice. There with mallet and chisel they dug into the rock and hollowed out nearly 30 temples and dwelling halls. On the walls and ceilings they painted exquisite frescoes portraying the life of ancient India.

In the 7th century the Buddhists mysteriously abandoned Ajanta to the jungle and moved to a hillside near Ellora, 50 miles away. Hindus and Jains joined them. During the next 200 to 300 years, the three sects carved another 30-odd temples.

I drove up to the Ajanta guesthouse at twilight. Leaving my Sikh assistant, Jai Singh, I walked off alone to see the temples before darkness closed in.

Soon I stood in the sweeping crescent of the wild Waghora River, gazing at a cliff that rose a sheer 250 feet from the stream bed (page 668). My eye was caught by four rock-hewn temples with cyclopean-eyed windows (page 666). Connecting them, massive columns marched 2,000 feet around the river bend. Behind those pillars lay the dwelling halls of monks who attended the temples.

As I strolled the path beneath the porticoes, I could imagine the bygone Buddhist monks walking as I walked, meditating, chanting prayers, and teaching students.

Visiting a monks' hall, I trod paths worn in the stone floor by the feet of countless pilgrims. I paused before shrines which showed Buddha in life (page 667) and in Nirvana (page 670). I explored cubicles where austere monks had slept on stone beds and pillows.

But it was not until the next day, when Jai set up lights for my cameras, that I noted Ajanta's artistic triumph—the frescoes. Color still glowed from painted walls; flowers a thousand years old sparkled like jewels. Vivid figures seemed to move with life. Gift-bearing ladies served godlike kings. Dancing dwarfs sang carols and played musical instruments.

But time had exacted a heavy price. The frescoes bore the marks of moisture, insects, and bats. Shellac, applied by restorers after Ajanta's rediscovery by British soldiers in 1819, had harmed rather than helped.

Later I spoke to an Indian friend about the tragedy of the paintings.

"Yes," he agreed, "much has been lost, but much has been won, too. The Ajanta frescoes, tattered as they are, have inspired a new school of art in Calcutta."

Visiting Ellora, we were guided by Livingstone M. Bhaktul, resident archeologist.

"During World War II," Mr. Bhaktul told us, "your American GIs came to Ellora in such droves that we had to put them up in tents. Our cook worked overtime preparing hundreds of box lunches. But the Yanks were nothing new, for Ellora has had sight-seers 13 centuries. Unlike Ajanta, it was never lost."

Ellora's temples stand out above a broad expanse of rolling hills. First the Buddhists dug out enormous halls; then Hindu and Jain sculptors fashioned temples next door. Under the talented Hindu artists, Indian sculpture reached a golden age. Their graceful and imaginative female figures have rarely been equaled (illustrations on following pages).

Dream of Heaven Endures

We saved the god Siva's Kailasa Temple for last (page 672). I had expected much. I discovered more. Accustomed to stone blocks and mortar joints, I found it hard to believe that not only the great temple itself, but obelisks, life-size elephants, and dancing gods were all carved in one piece. Quarrymen, starting work from the top of the cliff, laid bare a huge monolith for the sculptors.

"We estimate that the job took more than 40,000 stonecutters excavating 200,000 tons of rubble," said the archeologist. "Then the artists went to work. Finally, plasterers covered the temple walls and sculptures with a fine lime that shone as white as snow and glistened for miles away—a dazzling abode for Siva."

Plaster was peeling and statues had been chipped by image breakers, but the builders' bold dream of a god's heaven endured

Buddhist Monks Carved a Jewel-box Facade out of the Living Basalt 1,400 Years Ago

[illegible]

Buddha with Crossed Gestures Symbolically Turns the Wheel of the Law in Aloka

[illegible]

118

Beetling Cliffs and Creeping Jungle Hid Ajunta's Temples and Halls Until British Soldiers Rediscovered Them in 1819

[illegible]

Colossal Buddha Broods in an Ellora Cave

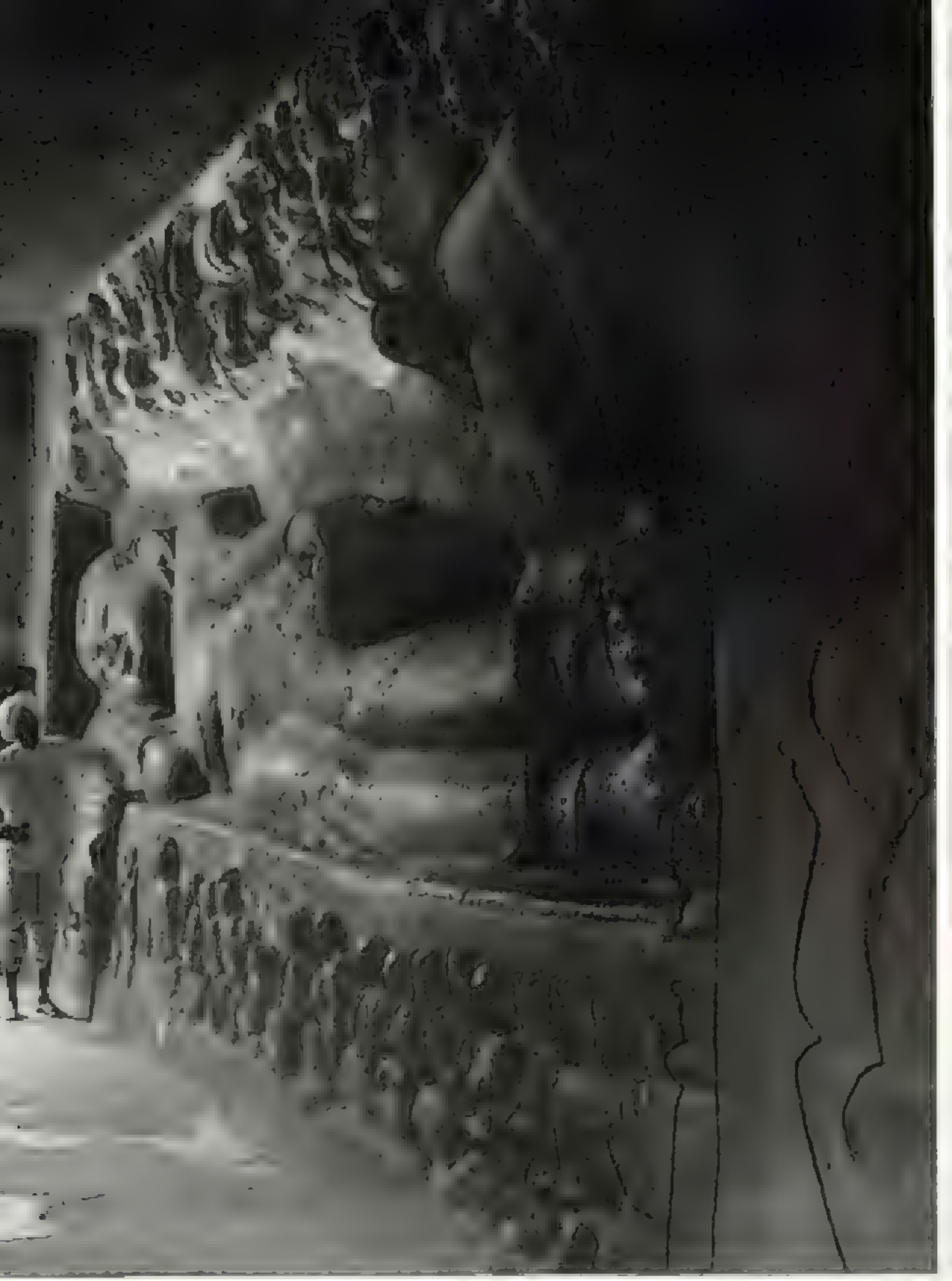
[illegible]

Ellora [illegible] people [illegible] Hindu [illegible] Buddhism. All these [illegible] and [illegible] Asia, [illegible]

Although Ellora was begun by Buddhists, [illegible] Hindu [illegible] Mystery [illegible] Mountain [illegible] Asia [illegible] Japan.

The Buddha [illegible] 11 [illegible] Tibetan [illegible] [illegible] [illegible]

[illegible]



69

Nirvana: A Chorus of Angels Fills the Sky as Buddha Enters Nirvana, His Blissful Oblivion

[illegible]

621

Mutesa, the Baganda's Mtesi I, Sits Enthroned Before a Stupa in Ebola

[illegible]

Kailasa Temple, Ellora's Glory, Was Carved from the Top Down out of Living Granite

[illegible]

63

Excavators Removed a Hillside to Expose Solid Rock for the Hindu Sculptors

[illegible]

A Weathered Stone Lion Guards the Entrance to Sita's Bath, in Ellora Cave

Siva Destroys with Many Arms

A Stately Maiden and Her Attendant Decorate a Niche Beside Sita's Bath

Giant Dwarfs Watch over Siva's Shrine

[illegible]

[illegible]

[illegible]

Vengeful Durga Brings Death to a Demon

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

678

Medieval Scrapers Gave This Mother the Hourglass Waist of Victorian Times

[illegible]

Macau, a Hole in the Bamboo Curtain

By George W. Long

With Illustrations by National Geographic cameraman J. Baron Kubert

ON THE border between Red China and the tiny Portuguese colony of Macau I watched traffic ebb and flow between two worlds.

Through the Barrier Gate barefooted farmers, trotting under creaking shoulder poles, brought fruit and vegetables from China. Slender Chinese girls carried stacks of small blue boxes made at home for a match factory in Macau.

Squawking chickens and swayed ducks pigs arrived in big rattan containers. Flocks of live ducks crossed the line, slung head down over the rear wheels of bicycles.

The only China-bound traffic I saw was an almost empty model-T bus and a gang of men carrying crude wooden coffins of Macau Chinese who wished to be buried in China soil. Red guards open even these to make sure they hold no contraband.

Portuguese officers kept careful watch but stopped no one. Near by, a jet-skinned guard from Mozambique faced a Red Chinese sentry.

"There's trouble now and then," said the captain in charge, "but it always blows over. Sometimes a Chinese guard tries to pull one of our African boys over the line. Then anything can happen."

Drumbeats sounded across the frontier. The captain smiled. "Morning indoctrination class to cleanse the thoughts of these farmers who must set foot on our soil," he explained.

Peephole and Listening Post

So small is this peephole in the Bamboo Curtain around Red China that most maps of the Far East show the colony as a mere dot. It covers a hilly peninsula only three miles long and a mile wide on the South China coast across the broad Pearl River (Chu Kiang) estuary from Hong Kong.*

Including two small islands—Taipa and Coloane—the whole colony totals only six square miles, but it supports some 300,000 people. About 99 percent are Chinese, many of them refugees.

Because of its location and its neutrality, Macau remains an important listening post. An agent of a foreign power may be sitting at the next table.

Macau was founded four centuries ago about the time the first Elizabeth ascended England's throne. It was Europe's earliest foothold and Christianity's first beachhead in China. No flag but Portugal's has ever waved above it. In its old Protestant Cemetery I found weathered tombstones carved with names of New England traders and sailors.

Today Macau is a strange blend of southern Europe and the Orient, the old and the blatantly new, the good and the seamy.

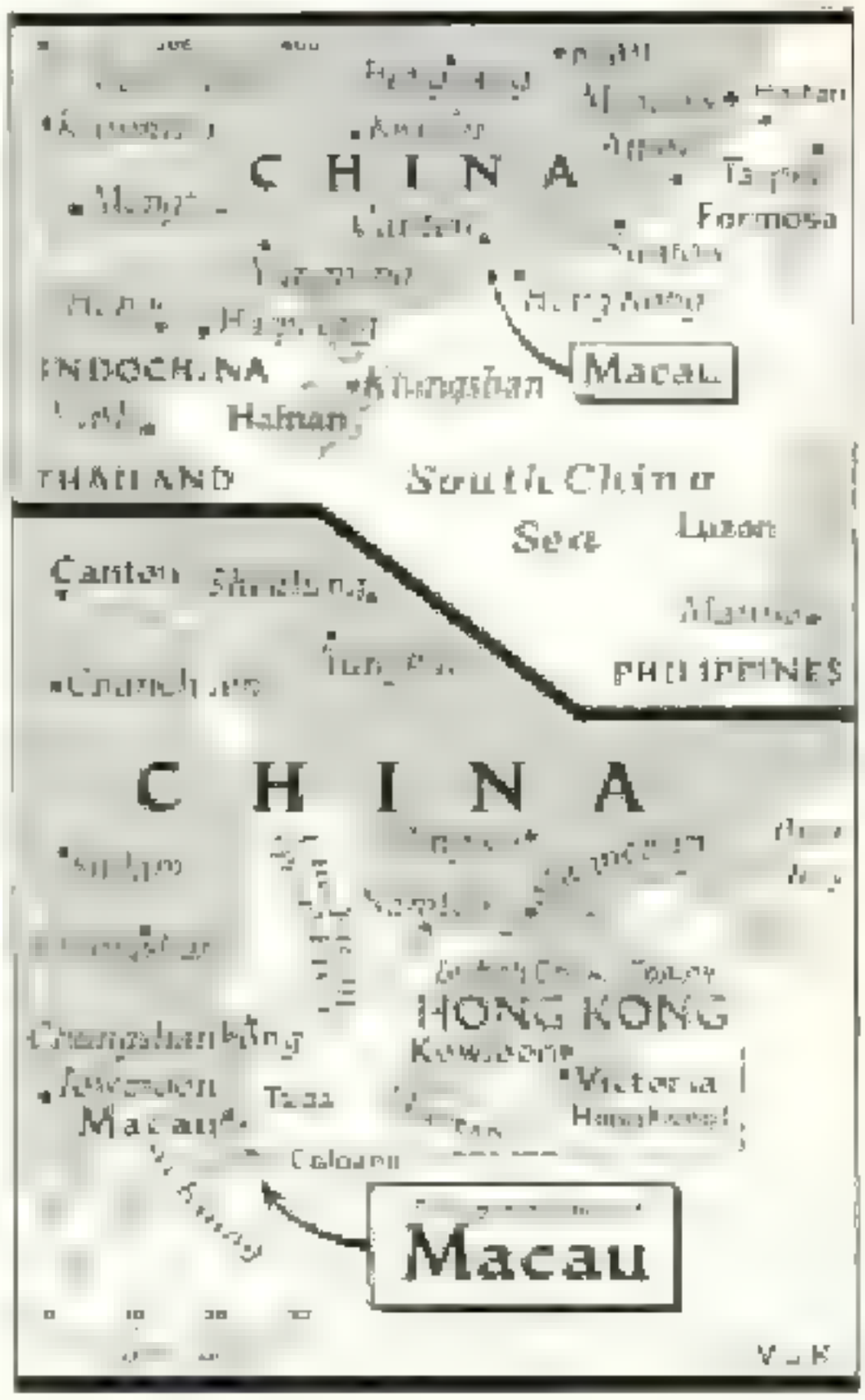
Over all lies the spell of sunny Portugal. Except among the Chinese, life is unhurried; there is a forever-siesta atmosphere. Church bells, rather than clocks, chime the hours.

Most of Macau's few thousand Portuguese belong to families that have lived in the colony for generations. Tenaciously they cling to the customs and manners of the homeland, but Macau is their first love.

"It is small, but it is so beautiful," they say.

No Place to Go But Hong Kong

Even so, Macau Portuguese suffer from claustrophobia caused by the Bamboo Curtain. Wistfully they describe the good old days—picnics on the mainland, boat trips on West River (Si Kiang), and excursions to Chinese cities like Canton.



* See "Macao (Macau), 'Land of Sweet Sadness'," by Edgar Allen Forbes, NATIONAL GEOGRAPHIC MAGAZINE, September 1952.

"Except for occasional trips to Hong Kong," I was told, "we are shut-ins."

Approaching the colony by sea, I saw first its quiet Mediterranean-like face—a timeless Riviera town climbing the peninsula's low green hills.

As the boat from Hong Kong rounded this headland and steamed into the riverlike inner harbor, a modern metropolis slid into view. Tall buildings loomed above the water front, lights regulated traffic on busy streets, and big neon signs splashed the scene with color.

American and British goods filled stores along Avenida Almeida Ribeiro, the main business street (next page). Chinese shoppers stared at window placards in English advertising Kleenex, Parker 51's, Kodak film, tooth paste, and a variety of beauty aids. Coca-Cola signs were numerous, and street vendors sold a dozen brands of American cigarettes.

Downtown, in a maze of narrow streets festooned with laundry, I shouldered through crowds of Chinese in black pajamalike garb. It was bedlam, like a bargain basement sale.

Hawkers shouted, pedicab bells jingled, wooden sandals clattered, and itinerant second-hand dealers sounded iron clappers. From upstairs rooms came the loud, furious rattle of mah-jongg pieces being shuffled.

Live Fish, Dried Snakeskins Sold

I window-shopped and watched artisans making brooms, rope, incense sticks, clogs, and fancy paper funeral pieces. In fish stores strange specimens in tanks stared back at me. Browsing in a Chinese drugstore, I discovered cures for every ill known to man, cures that included dried snakeskins, sea horses, lizards, and powdered boar tusks.

After dark the colony sparkles like a jewel against the black, forbidding hills of China. Lights of the business center set the sky aglow, and the latest in sodium street lights turn night into day along the broad avenues.

How the tiny colony supports its teeming thousands is something of a mystery. "We take in each other's washing," was the way one Chinese I met explained the economic puzzle.

Chinese are the businessmen, artisans, shopkeepers, laborers, and fishermen. Small, largely nonmechanized, factories turn out firecrackers (page 685), matches, sauces and preserved fruits, Chinese slippers, and textiles.

On the Barrier Gate is carved "Honor the fatherland and it will take care of you." Macau fulfills that promise and extends its care to thousands of refugees from China.

The colony has built living quarters for Government workers and large low-rent housing projects. Many institutions, some run by the Church, care for orphans, the sick, and the aged.

For years Macau has had a lurid reputation as a haven of opium smokers, smugglers, big-time gamblers, and sinister undercover agents. Long ago its name became synonymous with vice and cloak-and-dagger intrigue.

Macau people are concerned about this. "It is greatly exaggerated," they say. "It was true years ago, and even after the last war, but not now."

Opium Regulated, Gambling Curbed

The colony strictly regulated the use and sale of opium in 1946 and has now closed all but one gambling place, Government-licensed and operating on several floors of the modern 14-story Central Hotel.

Like most visitors, I went to the Central. On one floor, Chinese, Europeans, and turbaned Indians quietly played *fanc*, a dice game. On another I watched fan-tan.

At the head of a table ringed with players sat a fat, loud Chinese who looked like a Buddha. He held a slim ivory stick, and before him glistened a silver chalice upside down.

"Under the chalice is a pile of ivory buttons," a friend explained. "Buddha counts them four at a time with his baton. Players bet on whether 1, 2, 3, or 4 will be left over."

A bell rang; bets closed. Slowly, deliberately Buddha counted. Almost before he began, old habitués held up fingers to show the winning number. I never saw them miss.

Macau people gamble on more than dice and buttons. They are gambling on the future of their little garden spot on Red China's border, and they show little or no apprehension.

"We're in a tight spot, of course," Macau's Governor told me. "Every bit of our food comes from the mainland. We must trade with China or die. We keep strictly neutral always."

Over the centuries that policy has paid off. Macau has got along with Ming, Manchu, Nationalist, and—so far—with Communist leaders in China. Even the Japanese did not take Macau during World War II. Tiny as it is, and often threatened, it has remained under one flag longer than any other European settlement in the Far East.

Kodachrome by National Geographic Staff Photographer Paul A. Zahl

"Welcome!" Exclaims Macau, a Bit of Portugal in the Orient ▸

Though Portugal has ruled this small colony four centuries, Chinese comprise the overwhelming bulk of its 300,000 people. These gaudy street signs show how Chinese merchants dominate retail trade on Avenida Almeida Ribeiro, Macau's business center. Usually the avenue swarms with pedestrians, bicycles, and pedicabs. Here it is spanned with a bamboo arch erected as a greeting to Portugal's Minister of Overseas Territories, who paid an official visit in June, 1952.


BEMVINDO
歡迎羅瑟文部長蒞臨

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Fishing Junks Play a Daily Drama Below Banyan-shaded Barra Point. Red Cliffs Grim Hills Loom Across Inner Harbor

[illegible]

A Macao, The Rome, Rises on Seven Hills: the View Toward Penha Hill

Portuguese Sailors March Past Pastel Homes of the Praia Grande — Helmeted African Soldiers from Mozambique Present Arms

[illegible]


欽定四庫全書
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Silkworms in England Spin for the Queen

In a 15th-century Castle, Thousands of Pampered Larvae Make Silk for Elizabeth's Coronation Robe

By John E. H. Nolan

ONE April morning in 1952 a letter bearing the royal coat of arms arrived at Lullingstone Castle, stately and historic home of Zoë Lady Hart Dyke, pioneer [illegible] in silkworm culture.

"Her Majesty," the letter said, "would be pl[illegible] robe could be supplied by the Silk Farm at Lullingstone."

Lady Hart Dyke at once announced the good news to her staff of young silk workers. There were cheers, and some quoted the silk farm's motto: "Patience and perseverance turn mulberry leaves into the silken robes of a Queen."

Young Elizabeth is not the first English Queen to be associated with the estate of Lullingstone, which has witnessed more than 800 years of history. Queen Anne was a frequent visitor, first as a child and later as ruler from 1702 to 1714.

The castle, built almost 500 years ago, nestles in Kent County's scenic Darent Valley, 17 miles southeast of London (page 692). It takes its name from the original estate of Lullingstone, which was listed in the Domesday book in 1086 as the property of Odo, French Bishop of Bayeux, half brother of William the Conqueror.

Traditionally, the name Lullingstone came from the peaceful sound of the waters of the Darent River falling over stones on their way to the Thames.

How Silkworms Came to Lullingstone

Even more fascinating to me is the story of Lullingstone today. Here, in the short space of 20 years, Lady Hart Dyke has established a silk farm which not only attracts world-wide attention, but has received royal patronage.

Beginning with a handful of silkworms and a few mulberry leaves, Lady Hart Dyke struggled against pessimism and apathy to prove that Britain could produce raw silk as fine as the best from China and Japan.

Silkworms were brought to Europe in the 6th century, when two monks risked torture and death by smuggling a few of the prohibited eggs from Persia. The Oriental monopoly of the golden thread was thus broken, and from this one daring act all silk culture in the Western Hemisphere originated.*

At Lullingstone I saw the same methods of rearing the worms to the cocoon stage as had been perfected by the Chinese around 2000 B. C. Only the incubating and reeling operations have been improved.

The director's late husband, Sir Oliver Hart Dyke, designed and built the machinery for unwinding the cocoons. Her ladyship imported thousands of eggs and mulberry cuttings, and numerous books for studying the subject. To learn more about it she went to Italy and visited silk mills at Milan before starting the farm in 1932.

From the Palestine Government's nursery at Nablus, Lady Hart Dyke obtained 4,000 mulberry trees. From France she imported a few pounds of white mulberry seed, which she planted under glass.

Near the farm's herb garden, her veteran gardener, Tom Booker, who has served the family for more than 40 years, tended row upon row of seedling mulberries. Now there are 22 acres of mulberry trees.

In the castle itself, aided by three local girls, Lady Hart Dyke set up the incubation rooms, reeling and testing machines, and other equipment.

School Children Help Robe a Queen

By 1936 the silk farm was a great success. Inquiries poured in from many countries. People of all ages wrote or came to purchase eggs and mulberry seeds for starting their own silk farms. Her ladyship now buys back suitable cocoons raised all over Britain, mostly by school children (page 690).

Continuing the royal contact with Lullingstone that has existed since its first stone was laid, Her Majesty Queen Mary displayed great interest when visiting the farm. She asked Lady Hart Dyke the most searching and difficult questions about sericulture, and upon leaving, graciously accepted a length of green silk damask.

Then came the most important event in the silk farm's history up to that time. It was 1937, and Lullingstone was chosen to provide 20 pounds of raw silk for the coronation robe of King George VI's Queen, and for the robes of the little Princesses, Elizabeth and Margaret Rose.

The farm's maximum output was then only five pounds of raw silk a week, but, to fill the royal order, 20 pounds had to be produced in two weeks. This meant running the machines

* See "Spain's Silkworm Girl," by Luis Marden, NATIONAL GEOGRAPHIC MAGAZINE, July, 1951.

(690)

Children Count Cocoons, Their Silken Contribution to the Queen's Coronation

[illegible]

24 hours a day with the day staff of three working in shifts around the back. But the order was completed on time.

Gloria Spencer, a local girl, told me how [illegible] two colleagues slept in Lady Hart Dyke's unlined office during that [illegible] the same room from which Anne Hart, a 17th-century daughter of the house, escaped through an open window into the arms of her lover, handsome John Blunt.

In the Path of Flying Bombs

With the coming of World War II, the peace of the Kent Valley was rudely shaken. During the first months nothing serious happened and as time passed many [illegible] forgot the quiet of Longfield.

In the summer of 1944 death [illegible] the skies when Hitler's flying bombs either cut out overhead or scuttled past with a noise like a thousand rattling tin cans.

Soon the sullen letters known to Longfield as "doodlebug Alley" for witnesses the lads raise the Darent River, a tributary of the Thames, the winged bombs spell [illegible] Longfield [illegible].

During the last [illegible] of [illegible] more than [illegible] of all types [illegible] the [illegible] of the Darent. [illegible] were smashed or badly damaged. [illegible] the noise and fuss more than the [illegible].

Glass was replaced in the nursing home windows—[illegible] to [illegible]. Worries persisted by [illegible], caused by blast or cut to pieces by flying glass.

Falling ceilings [illegible] and ceiling fire [illegible] were put out of action. Cracks appeared in the stout walls of the Tudor gatehouse [illegible] tower a tattered Union Jack fluttered defiantly over the smoke-filled valley.

For several months Lady Hart Dyke slept in the nursing [illegible], always ready to draw protecting [illegible] over their heads. Often she had to throw herself [illegible] when a large [illegible] crashing [illegible] water [illegible].

Trees Burned by Incendiaries

The morning Lady Hart Dyke was [illegible] found with the fact that [illegible] necessary hospital [illegible] the staple food of [illegible] of silkworms reared in Longfield. [illegible] losses [illegible] would [illegible] and the silk worms [illegible] for use.

Lady Hart Dyke was at a loss, for there were not enough leaves [illegible] week. Suddenly she thought of the children who were [illegible] in many parts of England. Forthwith she penned the following

Silk Workers Follow Lullingstone's Banner in a Harvest Festival at Canterbury

[illegible]

Gallstones Has Been in the News for 867 Years

[illegible]

[illegible]

[illegible]

[illegible]

advertisement, which appeared in 50 newspapers:

"HELP! HELP! ! Lady Hart Dyke would be extremely grateful for sacks of mulberry leaves for her silkworms. Will those kind enough to help please send their sacks by post or rail to Lullingstone Castle, Eynsford, Kent. Do please despatch as soon as possible after picking, as mulberry leaves ferment very quickly."

The response was amazing. In two days nearly half a ton of leaves arrived. Boxes, brown-paper parcels, even envelopes, were delivered by every post. More than 50 percent came from children. The royal silkworms were saved.

In the midst of all this confusion 200 American colored troops arrived and were billeted in the castle's outbuildings. Most of them hailed from the Deep South. When off duty they volunteered their help to this brave but harassed woman. They displayed a natural aptitude for handling the worms.

Returning home late one night during a severe buzz-bomb attack, Lady Hart Dyke [illegible] light shining from St. Botolph's Church in the castle grounds, a violation of blackout regulations.

Investigating, she saw two lighted candles on the altar, and the pews seemed to be filled with dark forms. Sharply she called out, "Who's there?"

"Oh, ma'am," came the answer, "it's only us boys praying. [illegible] de ole doodlebugs."

"Our Worms Hate Crowds"

Even before I reached Lullingstone, I began learning about its unusual industry. Walking to the castle from Eynsford, where the train had dropped me, I overtook two children, both carrying small baskets of silk cocoons.

The oldest child, a boy, told me the cocoons were a present for the Queen.

"Yes," said his girl companion, proudly, "the silk will be worn by Her Majesty on Coronation Day."

Near a Tudor cottage unscathed by the war, we met three people on horseback. The boy pointed them out as visitors to the castle.

"Hundreds of folk come to see the silkworms at Lullingstone," he said as he ran along beside me.

"But when there are too many people," his companion chimed in, "they have to wait their turn. You see, our worms hate crowds—they like lots of fresh air."

At the castle entrance we were met by Maj. R. Field B.E.M., manager and secretary of the silk farm (page 691). After the children had run inside to deliver their cocoons, the major strolled with me across the lawn and smiled when I remarked on the fine quality of the turf.

"It should be good," he said, "for it was here that one of the earliest games of lawn tennis was played, in the late 1800's."

Three enormous cedars of Lebanon, almost 300 years old, flank one side of the castle; two have lost limbs to doodlebugs. Standing in the shadow of these stately trees [illegible] tiny St. Botolph's Church. Within, under sculptured effigies, rest members of past generations of the Hart and Dyke families.

At the annual Palm Sunday service, said the major, a special ceremony, Blessing the Silkworms, takes place in the [illegible] of St. Botolph's. Worms, skeins of silk, even small machines are brought in procession to receive the blessing.

"Last year," he added, "we attended two such ceremonies, one here and another at a monastery belonging to monks of the Benedictine Order."

Doll Left by Queen Anne as a Girl

The castle's mellow red-brick front, erected by a former member of the family to please Queen Anne, conceals its original character. Behind lies a Tudor courtyard overlooked by mullioned windows.

Inside, the great hall gripped my attention. Old paintings decorated its oak-paneled walls. One portrayed a 16th-century head of the house with his two sons. It belonged to the school of Holbein and was dated 1575.

My eye fell next upon a doll seated in an old carved chair. Said the major, "We call her Anne. It was left behind by that Queen on one of her visits when a child."

The doll wore a pink satin dress of beautiful quality, as brilliant as the day it was dyed some 250 years ago.

In an alcove hung a framed square of white silk. It was taken from the length of material made at Lullingstone for the wedding dress of Britain's young Queen, Elizabeth II. Designed from a painting by Botticelli, the dress had been embroidered with White Roses of York, starflowers, orange blossoms in pearl and crystal, and ears of corn.

The main staircase, the major informed me, had been built specially for Queen Anne, who was slightly lame and inclined to be plump. Broad, shallow treads enabled Her Majesty to use the stairs with dignity and without undue exertion.

At the top of this royal staircase I met a lady with very blue eyes and a determined-looking chin—Lady Hart Dyke (page 691). She greeted me with outstretched hand and a smile.

Just then the front doorbell rang, and the major left us to welcome a party of visitors.

[illegible]

A Silk Moth Emerges and Lays Her Eggs

[illegible]

[illegible]

[illegible]

[illegible]

4 The Larvae Cocoon for Five Weeks Before Spinning Laser Silken Strands

How Silk Comes from Fluffy Shells

[illegible]

[illegible]

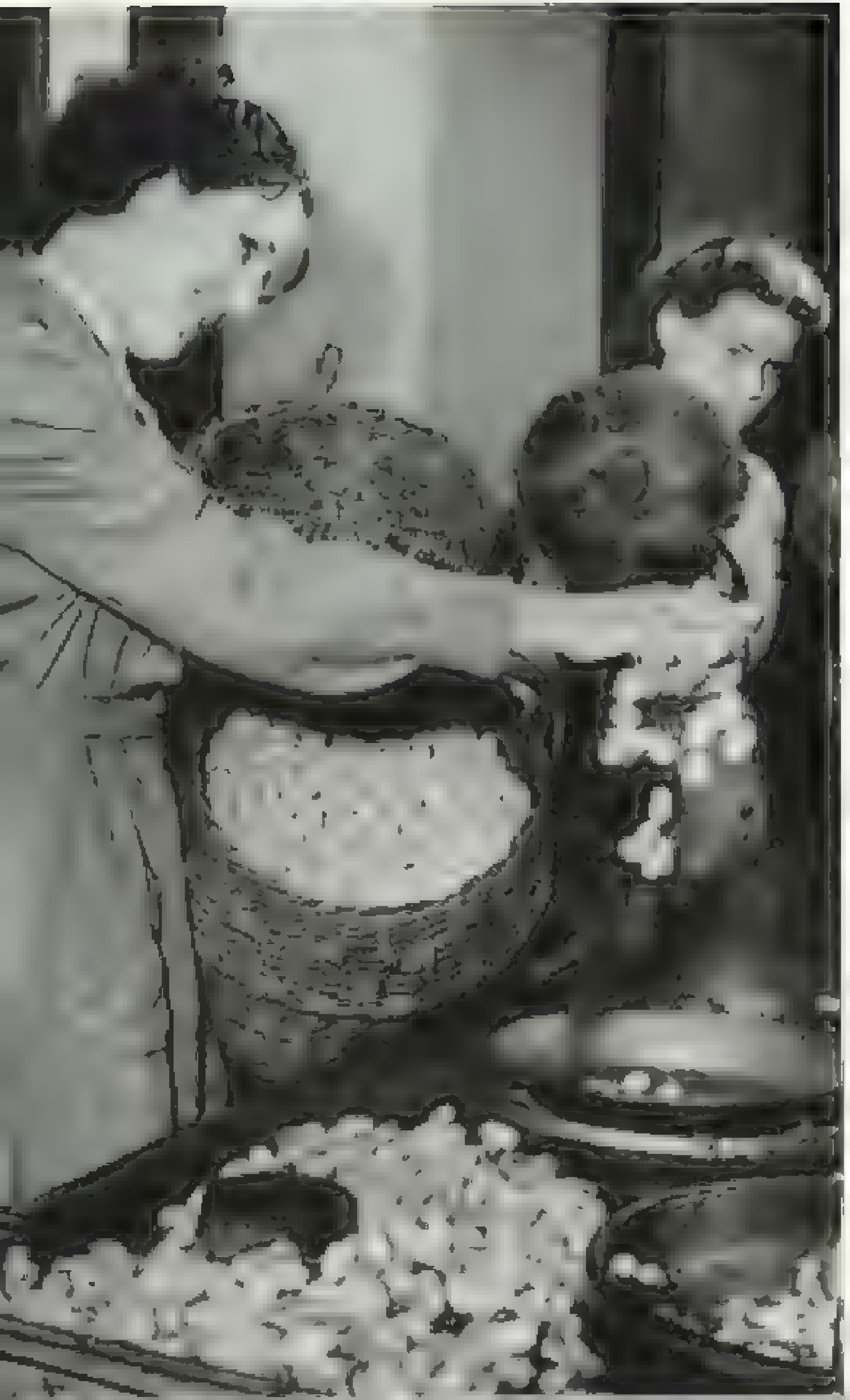
[illegible]

[illegible]

40 Cocoons Make a Double Handful

[illegible]


14



Girls Unwind the Cocoons and Reel the Silk

Women working in pairs [illegible] reel the thread [illegible]

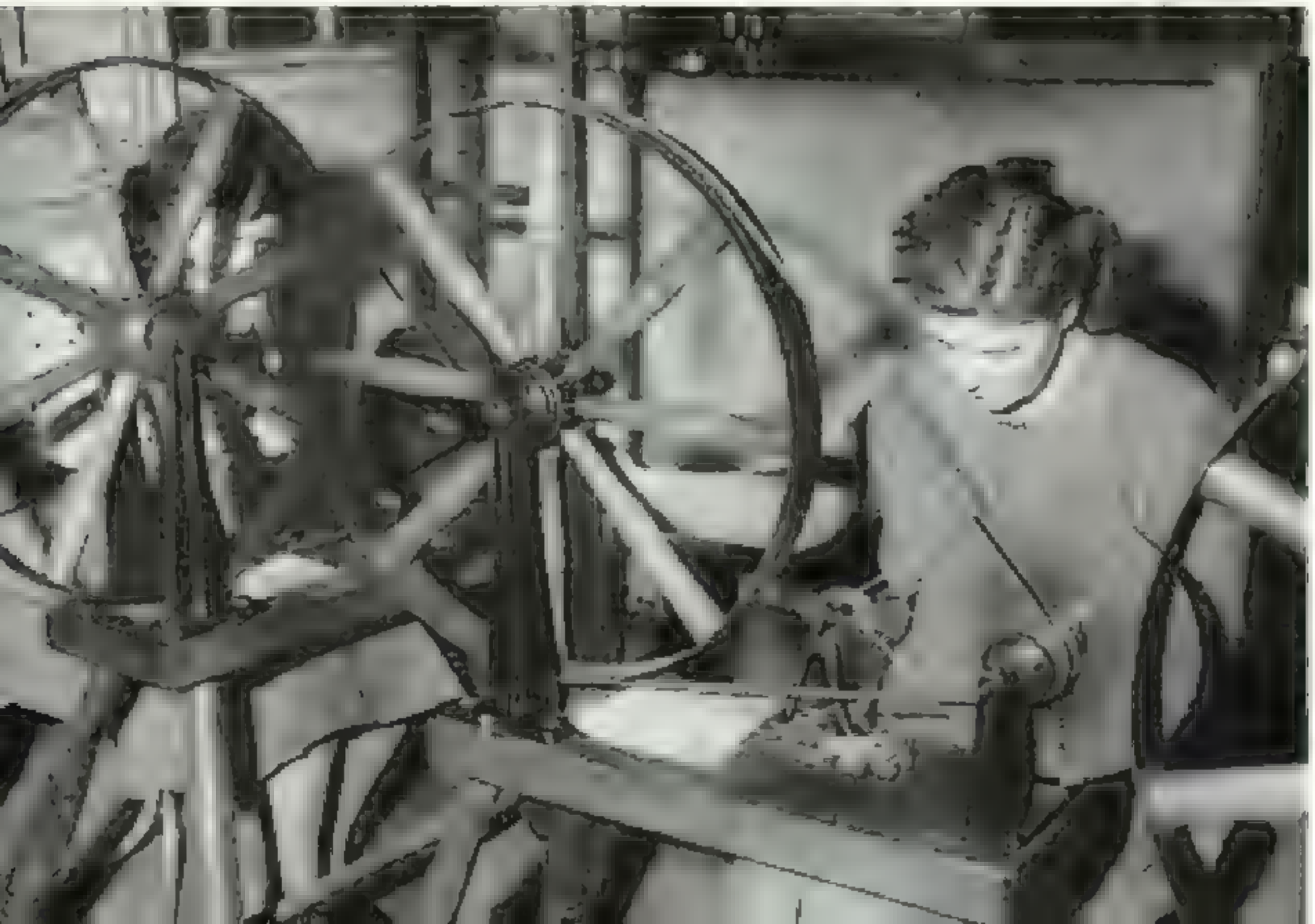
[illegible]

[illegible]

Photo

Inner Sketches Reach Tullinastone's Testing Room, Where Raw Silk Is Inspected

[illegible]



A Royal Velvet Is Hand-Loomed

[illegible]

[illegible]

"Always visitors," her ladyship commented with a laugh. "Last year nearly 40,000 came to see the silk farm. They come by bus from all parts of Britain, and more than half are children.

"Come along," she added, "I'll show you the Tudor kitchen first."

Silkworm Eggs in Castle Kitchen

I expected to see a lot of old spits and copper pots and pans. Instead, I saw a number of wooden racks, with hundreds of small white cotton bags suspended from them.

Lady Hart Dyke explained that the entire silk farm was housed within the castle walls, except for greenhouses and nurseries containing some 30,000 small mulberry trees, and the kitchen was now the egg laying room. Each little bag, she said, contained a female moth of the silkworm, placed there after mating.

After about four weeks, the bags are opened. This allows time for each moth to lay 300 to 450 eggs, after which she dies (page 695).

Dead moths are removed, and the eggs are stored in boxes in a cold, dry room till a time in spring when the mulberry leaves are the size of an English halfpenny. Then they are placed on muslin-covered trays and put into an incubator.

At Lullingstone the incubators are simple square wooden boxes on legs, lined with metal jackets for holding water. The water is heated by a small oil lamp set on a movable bracket underneath so that it can be raised or lowered according to the temperature required. Usually the eggs hatch in about seven days at 72°F.

The silkworms normally hatch in early morning. They break the egg by biting through the side of the shell.

On emerging, they are about one-twelfth of an inch long, dark, and covered with long hairs which disappear after the fourth day. Nature provides the hairs to protect worms against overcrowding or crushing by their fellows. Because of their size, color, activity, and sharp jaws they are called "ants" at this period of their lives.

To remove the worms from the incubator, pieces of finely perforated paper are placed over the trays, and strips of mulberry leaf are laid on top. Attracted by the smell of the leaf, the worms wriggle through the holes, which prevent empty shells or unhatched eggs from being dragged along by the thin filament of thread exuded by the newly hatched worm.

When all the mulberry strips are covered with worms, they are placed upon large trays and taken to the rearing rooms (page 693).

On our way there along an oak-paneled corridor hung with antique pistols and blunderbusses, we met the major again, surrounded by a party of excited children. Many carried cardboard boxes.

"They are full of cocoons," her Ladyship explained. "Thousands of children are sending their home-produced cocoons to be turned into silk for the Queen's coronation robe."

In a rearing room a vast sea of silkworms crawled over long trays set up in tiers. The scent of fresh mulberry leaves filled the room.

Busy Chewing Sounds Like Rain

At first I was puzzled by a curious sound, somewhat like that of falling rain. It was the sound of the silkworms' busy jaws cutting into dry leaves. The leaves must be dry, since dampness causes various ills of the domesticated silkworm.

The worms are fed five times a day. For the first ten days the mulberry leaves are cut into small pieces; then larger ones are provided until finally the worms receive whole leaves (page 690).

"How long do they live, and how much do they eat?" I asked.

"Not very long—only 35 to 40 days," said my guide, "but in that time each worm consumes about three-fourths of an ounce of mulberry leaf."

Along with this heavy intake of food goes rapid growth. On the sixth day after hatching, the loosely fitting skin falls out, but since the skin does not grow with the rest of the body Nature steps in and causes the creature to molt, or cast its skin.

This process occurs four times before the worm is ready to make its cocoon.*

Lady Hart Dyke pointed to a worm that was molting. With almost acrobatic contortions, it drew itself further out of its old envelope.

The silkworm, I learned, has an odd way of breathing. Unlike most creatures, it does not breathe through its nose or mouth but through nine oval holes along its sides.

Each Worm Spins 1½ Miles of Silk

In a room next door these strange insects were in a more advanced stage. From three to four inches in length, their almost transparent bodies were greenish gold. Beside their trays were neat, tent-shaped bundles of straw.

Having molted the fourth time, the worms had finished their growth. Their tiny reservoirs were full of liquid silk, and the time to make their cocoons had come.

I watched a worm which had started to spin

* See "Strange Habits of Familiar Moths and Butterflies," by William Joseph Showalter, NATIONAL GEOGRAPHIC MAGAZINE, July, 1937.

Peers and Peeresses Carry Coronets and Wear Crimson Velvet Trimmed with White Fur

Tailors and dressmakers worked for a year preparing robes for the peerage at prices ranging from $3,500 [illegible] for [illegible] robes. These robes [illegible] Peeresses wear diadems [illegible] Peeresses with peer [illegible] members of the Archbishops [illegible] attendants [illegible] the [illegible]

its cocoon. Its body emitted a thick viscous solution which solidified into a thread of silk as it came into contact with the air. Equipped with two sacs, the worm soon created a second thread. Covered with a natural gum, the two threads adhered, resulting in a single thread of greater strength.

My worm had suspended its "hammock," or safety net, between two straws and was now wrapping silk around itself in the form of figure eights (page 696). While I was engrossed in this remarkable exhibition I was reminded by the major that I should have to wait three days for the cocoon to be completed.

"In that time," he said, "the worm will have moved its head back and forth some 300,000 times and spun about a mile and a half of silk."

Cocoons are plucked from the straw tents in the manner of cotton being picked. Then all except those set aside for reproducing the next season's moths are placed in sacks and taken to the stifling ovens.

Emerging Moth Would Ruin Silk

Were it not for the stifling process, the caterpillar would emerge from the cocoon as a moth and spoil the silk.

Unlike the worm, which bites through the egg to free itself, the moth has no jaws with which to bite its way out of the cocoon. Instead, from two glands in the head, it pours a drop of alkaline fluid upon one end of its silken prison (page 695).

This fluid has a solvent effect, not upon the silk itself but upon the natural gum with which the silk is covered; its action causes the threads to loosen so that they can be pushed aside by the moth. But if the moth were left alive to escape its silken cell, the fluid would leave an indelible stain on the silk.

Cocoons can be stifled by gas or steam, or by dry heat, the method used at Lullingstone.

"Our methods may be primitive, but they are adequate," Lady Hart Dyke remarked. "We leave the cocoons for about an hour, at a temperature of between 168° and 174° F. That is sufficient to kill the pupae before they form into moths and yet not damage the silk."

Her Ladyship demonstrated how the rough silk, or floss, is stripped from the outside of the cocoons. Taking a handful of cocoons, she placed them in a hopper above a long, sloping tray fitted with three rough-sided, revolving metal rods. As the cocoons slid down the incline they were caught by the rods and freed of floss by the time they reached the bottom.

After being sorted for size and quality, the cocoons are taken to a vermin-proof storeroom until the reelers are ready to unwind their silk.

The reeling shop, a large steam-filled room, was once the castle's laundry. At work here were six girls, two to each reeling machine. These machines are in two parts, the cocoon basin and the actual reeling apparatus (pages 698 and 699).

Suspended in each basin, full of boiling water, was a metal colander held fast by clips. Some 50 cocoons were placed in this receptacle under a revolving brush. Set in motion the brush swept the now softened cocoons round and round. After about 35 revolutions it was lifted, and there, clinging to its stiff bristles, I saw a number of silk threads.

Thickness Is Important

The girl jiggled these silken strands gently up and down in the water until the cocoons began to unwind, then she handed them to the girl opposite. This operator fed the ends of the threads into revolving disks which carried them up to a series of pulleys and so onto large revolving spindles.

The silk then being reeled was for the lining of the Queen's coronation robe, so extreme care was being taken to insure that the thickness of the thread remained standard.

This standard is known as the denier, or measurement of a thread's thickness. It is based on the weight for a given length, which is obviously greater for a thicker thread. The name originated from an old French coin once used as a weight for weighing silk. A single cocoon thread is normally about three deniers.

From the reeling shop, with its rather sickly odor, we went to the testing room. Here the skeins from the reeling cabinets were being stretched, opened out, and searched for loose ends, thick threads, and bits of fluff.

At intervals tests were made of the skeins by measuring off 450 meters of thread and weighing it on a very delicate scale.

When this examination was completed, the skeins were laced, twice in white to keep them neat, and once in red to indicate the beginning and end of the thread. They were then twisted, like skeins of wool, and parceled into "books" ready for dispatch to the weavers.

Industry Grew from Childhood Hobby

Although I had seen almost everything in this home of royal silk and had listened with great attention to the absorbing story of the silkworm's life and work, I still had one question for her ladyship: "What made you keep silkworms?"

"That is a difficult question," she replied with a smile. "I first became interested in these strange little creatures when I was four. I started silkworm rearing as a hobby—and this grew into the small industry you see today."

Burr Prizes Awarded to Dr. Edgerton and Dr. Van Biesbroeck

FOUR extraordinary contributions to science in cooperation with the National Geographic Society, Dr. Harold E. Edgerton and Dr. George Achille Van Biesbroeck [illegible] The Society's [illegible] Burr Prize consisting of cash awards.

Dr. Edgerton, professor of electrical engineering at the Massachusetts Institute of Technology, [illegible] flashlight for ultra-high-speed photography. Dr. Van Biesbroeck, of Yerkes Observatory, who is professor emeritus of astronomy at the University of Chicago, [illegible] that starlight is bent by the sun's gravity, as predicted [illegible] Albert Einstein in accordance with his theory of relativity.

The Frank O. L. Burr Prize was established under the bequest of the late Mary C. Burr, Hartford, Connecticut, who bequeathed a fund to the National Geographic Society in memory of her father. Miss Burr's will directed that the income be used in the awarding of cash prizes [illegible] Trustees to have done especially meritorious work in the field of geographic science.

Dr. Edgerton developed light-[illegible] that flash as briefly as a millionth of a second. They have made it possible for photographers to picture a bullet traveling 1,500 miles an hour, the vibration of an electric bell, [illegible] sufficiently to impress its image upon the film only during the almost instantaneous flash.

A [illegible] photograph in the NATIONAL GEOGRAPHIC MAGAZINE of bats in flight and of a [illegible] that [illegible] 55 times a second owe their existence to Dr. Edgerton's genius. The inventor made some of the pictures [illegible] photographs.

On January 12, at a luncheon [illegible] honor at The Society's headquarters, [illegible] with a check for $2,000. Mahlon [illegible] presented Dr. Gilbert Grosvenor, president of the National Geographic Society and editor of its magazine, remarked that The Society has been [illegible] in its mission of increasing and [illegible] knowledge through the use of equipment designed by Dr. Edgerton for the specific needs of its staff photographers.

"[illegible] Dr. Edgerton," said Dr. Grosvenor. "It has helped us achieve results of great value.

Edgerton Flash Stops a Bird in Flight

[illegible] the electronic [illegible] flash photographs [illegible] The twenty-four [illegible] Last of a male Anna's Hummingbird in California. [illegible]

Dr. Van Biesbroeck on Sudan's Sands
Prepares to Shoot an Eclipse

[illegible]

Dr. Edgerton never has permitted the National Geographic Society to pay him personally for his work. Now, through this [illegible] deserved award made possible by the distinguished Bell family, the society can repay part of its own indebtedness to him while expressing the gratitude of the entire world of geographic science.

Whenever one starts anything new," Dr. Edgerton said in reply, "it is usually a lone time before anyone appreciates or uses it but almost immediately, in this case, there came inquiries from the National Geographic Society, followed by encouragement and practical tests of the equipment.

"[illegible] the Society and its photographic experts [illegible] of inestimable value."

Trustees of The Society present at the luncheon, besides Dr. Grosvenor, were Dr. Lyman J. Briggs, Franklin L. Fisher, Dr. Robert V. Fleming, Dr. Alexander Wetmore, Dr. Hugh L. Dryden, Dr. William E. Wrather, Melville Bell Grosvenor, Rear Adm. L. O. Colbert, U. S. Coast and Geodetic Survey, Ret., Vice Adm. Frank S. Lowe, U. S. Navy, Ret., and Dr. Thomas W. McKeever.

Also present were members of The Society's photographic staff who have worked closely with Dr. Edgerton. Edwin L. Wisherd, chief of the photographic laboratory, a pioneer in realized the use [illegible] Dr. Edgerton's flash equipment. Using it, he made pictures on flying squirrels that showed clearly for the first time how the [illegible] squirrels achieve their startling flights.

Dr. Edgerton is a native of Fremont, Nebraska. Two years after his graduation from the University of Nebraska in 1925 as a Bachelor of Science, he earned a Master of Science degree from the Massachusetts Institute of Technology, later a Doctorate of Science.

Dr. Van Biesbroeck
Confirms Einstein

Dr. Van Biesbroeck received his award, $1,000, at his home in Williams Bay, Wisconsin. The distinguished astronomer, in cooperation with the United States Navy and Air Force, in 1952 led a National Geographic Society expedition to Khartoum in the Sudan, where he photographed the star field around the sun during its total eclipse of [illegible].

He returned to Khartoum in August and with the telescope standing in exactly the same place, he photographed the same stars in the same relative position at night. By comparing the two sets of pictures, he measured accurately the displacement of the star images caused by bending of their light as it passed the sun.

Almost 50 years before, Dr. Einstein had calculated that the shift would be [illegible] of an arc-minute at one degree of [illegible]. The amount of displacement observed by Dr. Van Biesbroeck was between [illegible].40 and 2.[illegible], with an average of 1.[illegible] seconds of arc.

Born in Geel, Belgium, Dr. Van Biesbroeck studied astronomy [illegible] in Germany. He came to the United States in 1915 as a visiting astronomer and became an American citizen in 1922. His association with the University of Chicago where he was adjunct professor of astronomy from 1924 until 1[illegible] started in 1917.

[illegible] Science," by Harlow Shapley, National Geographic Society, Washington, D. C., [illegible]

[illegible] Science," by Harlow Shapley, National Geographic Society, Washington, D. C., [illegible]

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To carry out the purposes for which it was founded, [illegible] National Geographic Magazine [illegible]. All [illegible] are invested in The Magazine [illegible] to promote [illegible].

Articles and photographs [illegible] in general. The [illegible].

[illegible] to the [illegible] and [illegible] large scale. The Society has [illegible] scientific expeditions, some of which [illegible] work to achieve their objectives.

The society's notable explorations have [illegible] the historic homes of the southwestern Cliff Dwellers to a period [illegible] years before the Aztecs, by tracing the trails of the [illegible] Dwellers [illegible] to their sources. The Society's [illegible] last stage for Bering's undiscovered [illegible].

In Africa, The Society and the Smithsonian Institution, January 16, 1931, discovered the oldest [illegible] in the Americas for which we have a date. This [illegible] is preserved in Maya characters with a date which [illegible] 4,291 [illegible] Christian [illegible]. It was later by the [illegible] passing [illegible] in Africa, [illegible] a [illegible] of [illegible] African [illegible].

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's highest [illegible] Captain Albert W. Stevens and Captain Orvil A. Anderson [illegible] the stratosphere and obtained results of extraordinary value.

A notable [illegible] in the history of astronomy was [illegible] in 1937 by The Society in cooperation with the Lick Observatory of the California Institute of Technology. This project was [illegible] from space to photograph the [illegible] and was generously the first [illegible].

[illegible] expeditions to study the [illegible] Bureau of the American [illegible] and the Inland Chinese [illegible].

[illegible] Society granted $25,000, and in addition $75,000 was [illegible] by individual members to help preserve for the American people the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

[illegible] the past year the [illegible] in Alaska and Labrador [illegible] for The Society and the [illegible] of Washington, 1938.

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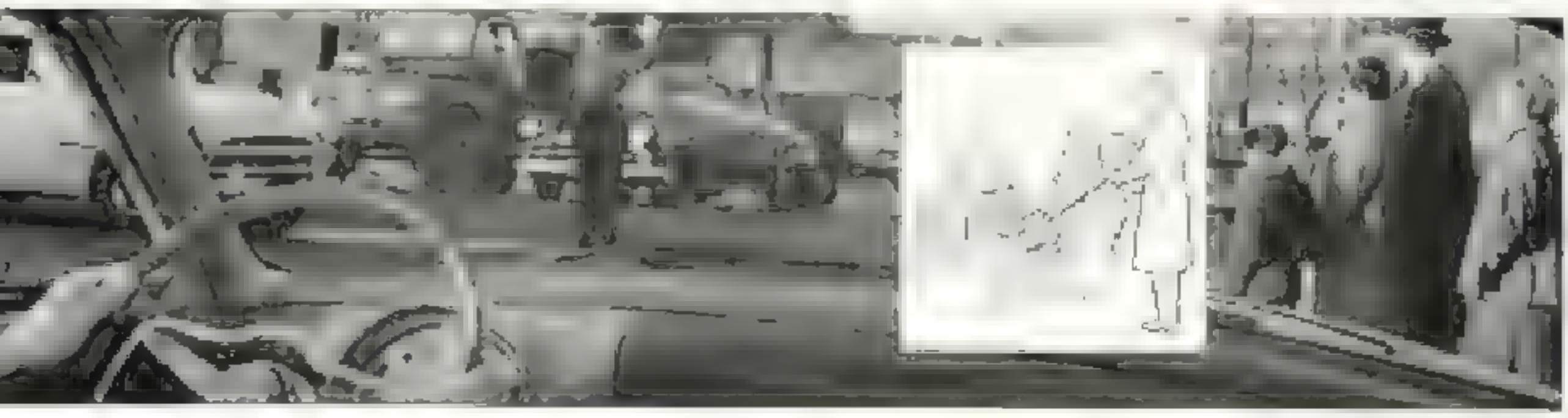

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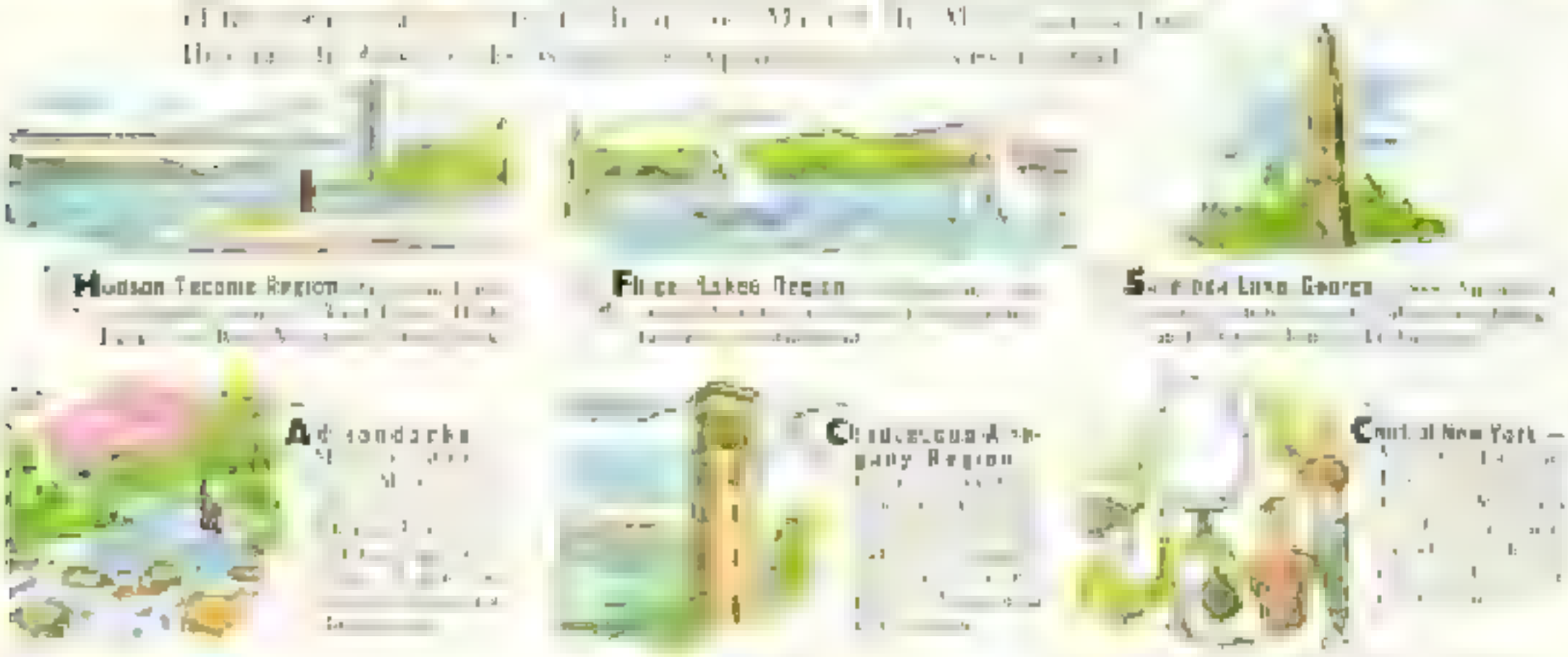

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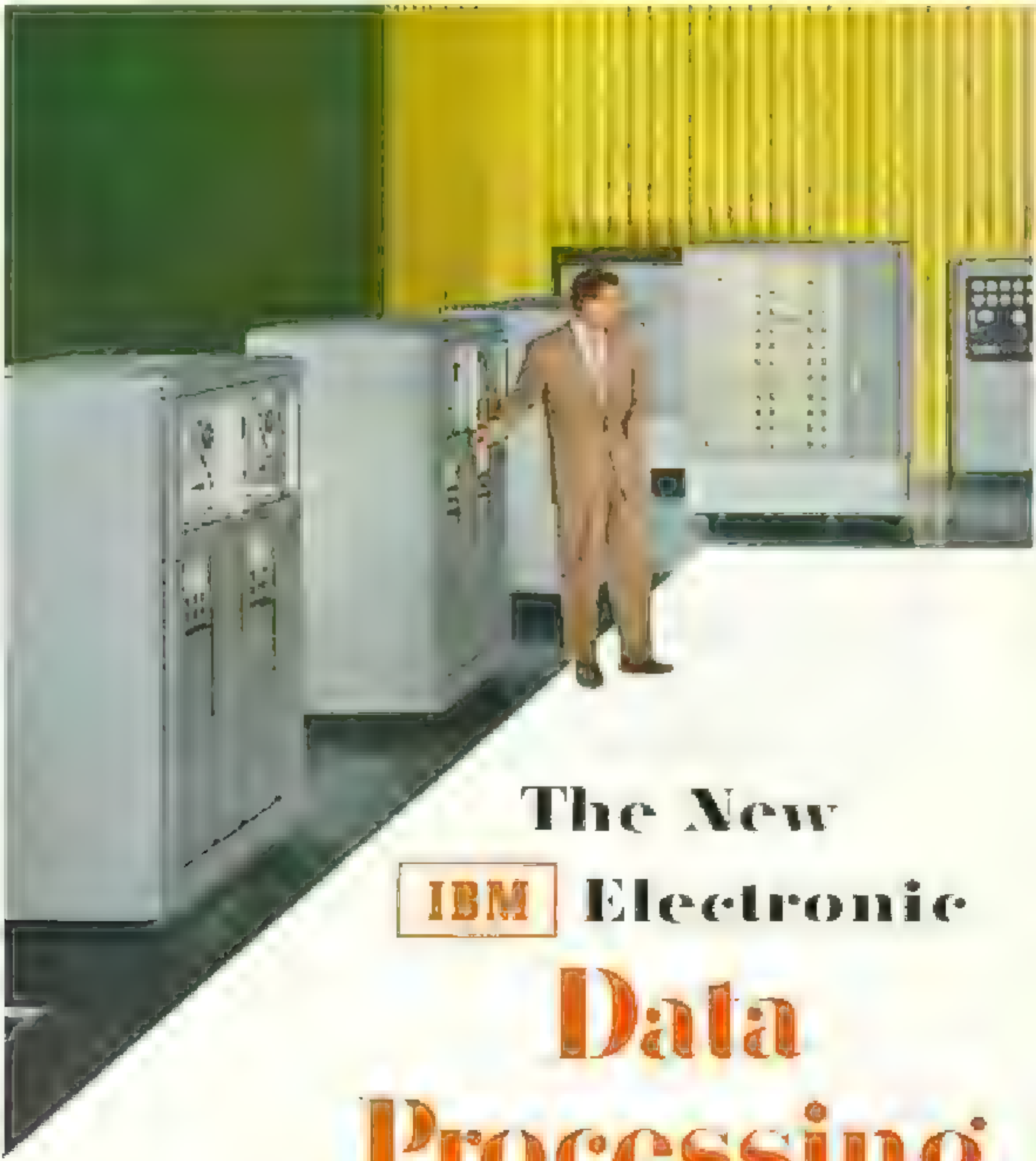

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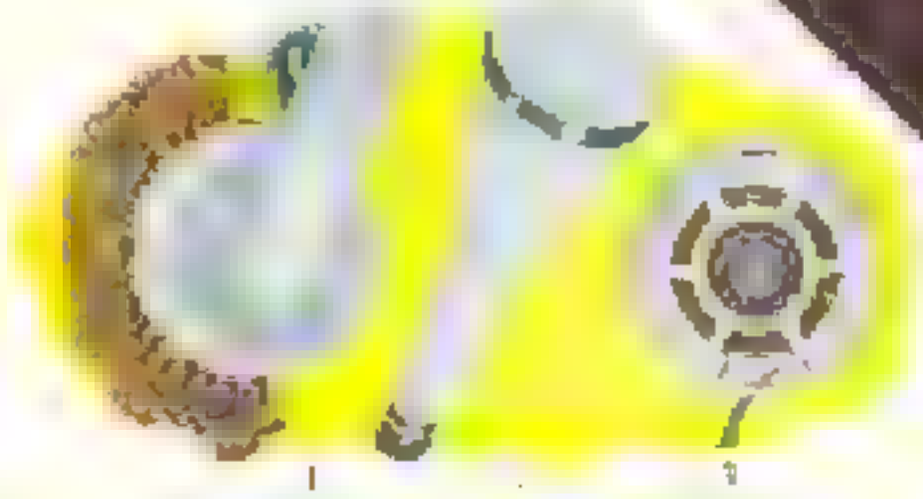

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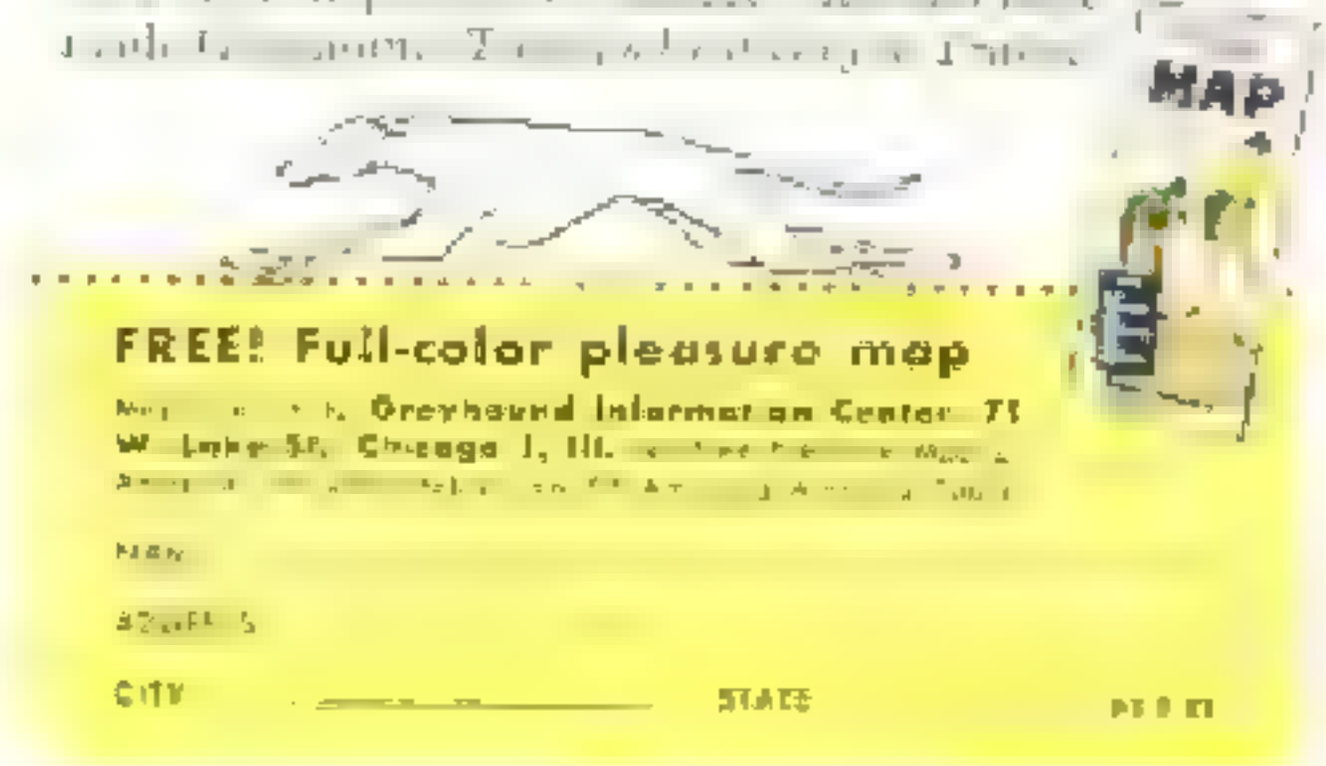


FREE! Full-color pleasure map

[illegible] Greyhound Information Center, 71 W. Lake St., Chicago 1, Ill. [illegible]

NAME

ADDRESS

CITY _____ STATE

[illegible]

A quick tour ... *to a land of new profits*

One of the Profitlands of your business future is the Land of Glass.

During the next few months, you will be planning for 1951. Perhaps you'll be thinking about premiums, or about necessities, or about new products.

We would like to plan with you, as we have done with hundreds of other forward-looking manufacturers.

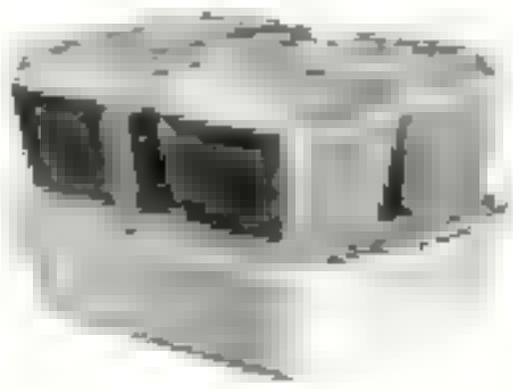
For example, we might discuss how premiums of heat-resistant Pyrex brand glasses can help you sell more goods; or how—if you make kitchen appliances—attractive Pyrex bowls, dishes or refrigerator sets might raise your competitive position; or how you might use lowest Pyrex brand glasses instead of other high-cost materials and save money while boosting sales. Pyrex ware is so popular with American women that 90% use it now and always want more!

A quick tour of the pictures at the right and of our descriptive brochure about glass in industry—free of cost or obligation—may offer more excitement than a trip to Bali! May we hear from you before your plans have jelled?

Beverage Server

Household Vacuum Carafe

Pyrex Colored Casserole with Cover



Pyrex Refrigerator Set

Corning Coffee Maker

Corning Glass Works

CORNING, NEW YORK

Corning means research in Glass

CORNING GLASS WORKS, 155 Crystal St., Corning N. Y.

Please send me a copy of your new brochure, "Glass and You."

Name _____ Title _____

Company _____

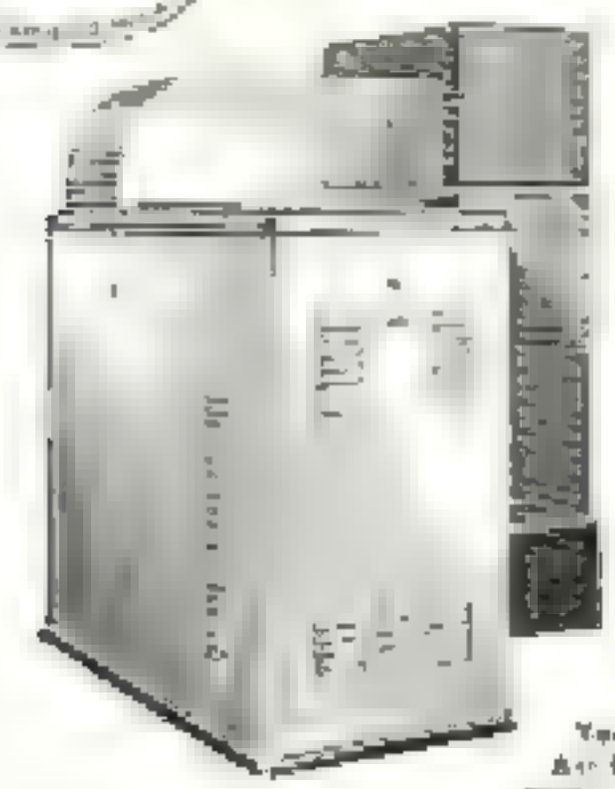
Address _____

City _____ Zone _____ State _____

*PYREX is a registered trade mark of Corning Glass Works in the United States

K *is for Kitten*

Room Air Conditioner



Year-Round Air Conditioner

so playful and gay,
with Chrysler Airtemp . . .
the weather's like May!

May weather inside your home all year 'round has many advantages. Every room in your home stays cleaner, fresher . . . needs less housework . . . when you have Chrysler Airtemp Year 'Round Air Conditioning. Your drapes and furniture stay new looking—retain their beauty for years.

Your family will be healthier, more comfortable, too. In the hottest part of summer or in winter cold, you and your family can live in a *Springtime* climate tailored to YOUR wishes.

Chrysler Airtemp

HEATING • AIR CONDITIONING
for HOMES, BUSINESS, INDUSTRY

A Major Division, Chrysler Corporation, Dayton 1, Ohio

Comfort Zone

Get a free copy of the delightful Alphabet Book for children. It shows many benefits of Chrysler Airtemp Air Conditioning for you and your family.

Airtemp Division, Chrysler Corporation
P. O. Box 1037, Dayton 1, Ohio

I want to know more about the Chrysler Airtemp Comfort Zone
Send me my free copy of the Chrysler Airtemp Alphabet Book

Name _____

Address _____ Phone _____

City _____ Zone ____ State _____

Mention the National Geographic when you write us

Star of the silky way

This one has to be good. It [illegible] Necessary [illegible]

So [illegible] your skids, [illegible] and [illegible] when you drive. [illegible] you will come to know how [illegible]

You'll [illegible] the [illegible] power [illegible] Roadmaster and [illegible] Roadmaster.

You'll [illegible] the [illegible] of its power—with [illegible] for another [illegible] for acceleration to infinite [illegible]

You'll know [illegible] the velvety luxury of its [illegible] in the [illegible] in the more precise [illegible] Figure [illegible] Steering [illegible] to lighten the task of [illegible]

[illegible]?

It is for you. The [illegible] the [illegible] of the [illegible] the [illegible] the [illegible] the [illegible] the [illegible] of [illegible] finishing.

Your Buick dealer will be very happy to introduce you two. Why not drop in and [illegible]

BUICK Division of GENERAL MOTORS

WHEN BETTER AUTOMOBILES ARE BUILT BUICK WILL BUILD THEM

Custom Built **ROADMASTER** by Buick

"I've waited a whole year for this!"

[illegible]

Travel Tips.

- We staffed reception centres at all border crossings to help you plan your trip
- Warm days, cool nights.
- Excellent shopping, with bargains everywhere

ONTARIO

CANADA VACATIONS UNLIMITED

Ontario Travel
41 C Parliament Bldgs., Toronto 2, Ontario
Please send me free guide map and 64 page [illegible]

Name .....

Street .....

City ..... State ....

35mm Shooting is fun...

..but the real thrill is the show!

La Belle "500"

$95.00*

America's ONLY AUTOMATIC projector ...

$154.95*

[illegible]

La Belle industries, inc.

IN CANADA—PRECISION CAMERAS, MONTREAL, QUEBEC

Choose your WESTERN VACATION SPOT here...

then go in style aboard NP's faster NORTH COAST LIMITED

ALASKA CRUISE

Cruise the Inside Passage to Alaska past majestic icebergs, towering fjords, Visit Eskimo villages, "gold rush" towns. From May to October, sea trips are available to Ketchikan, Juneau, Skagway, Sitka, Gulf of Alaska, Kodiak, Seward, Prince William Sound, Columbia Glacier, Valdez or Cordova. NP will arrange one-to-three-week cruises for you, take you west on either of our fine transcontinental trains, the North Coast Limited or the Mainstreeter. Round trip steamship fares begin at . . . **$160**

DUDE RANCHES

Pick your own brand of western fun. Youngsters will like a real workin' ranch; you might prefer a rough-and-ready camp or a luxurious mountain lodge. NP has information on ranches in Montana, Wyoming, Washington and Oregon. We'll make your reservations that speed you to your ranch vacation destination. Upon arrival you'll get your first taste of western hospitality—our famous dinner menu with the "Great Big Baked Potato." Weekly ranch rates, including meals, use of horses from . . . **$60**

YELLOWSTONE PARK

Bring your camera for snapshots of animals, geysers, spectacular scenery in America's favorite playground. Go NP and choose from three Park entrances—thrilling Red Lodge High Road, Paradise Valley and the Gardiner Gateway, and rugged Cody Road. Old Faithful Inn, Grand Canyon and Mammoth Hotels open June 22—Sept. 10 for tours of 2½ days or longer. NP offers shorter trips Spring and Fall. All-expense tours from Chicago to Yellowstone and return via the Mainstreeter, from . . . **$143**

PACIFIC NORTHWEST

Take your choice of mountains or seashore. Relax, climb or fish at Rainier or Olympic National Parks, at Mt. St. Helens or Mt. Hood. Fish the famed Columbia for fighting salmon. Sail Puget Sound to San Juan Islands, Victoria or Vancouver, British Columbia. Stopovers and diverse routing privileges make it easy—and inexpensive—to include Spokane, Lake Pend Oreille, the Canadian Northwest or California on your tour. Round trip fares, Chicago to Seattle, Portland or Tacoma, as low as . . . **$82**

How to make the most of your vacation...

Easiest way to arrange a vacation is by mail. Why not try it this summer? Just write us a letter, name the places you'd like to go. We'll plan a program for you, mail it promptly — with complete costs and schedules. If it suits you, order your reservations and tickets from us by mail. It's as simple as that.

You can stretch vacation time and money, too, when you travel NP. Low train fares actually cost you less than driving your own car. And Northern Pacific's new streamlined schedules save you extra hours for fun when you get where you're going.

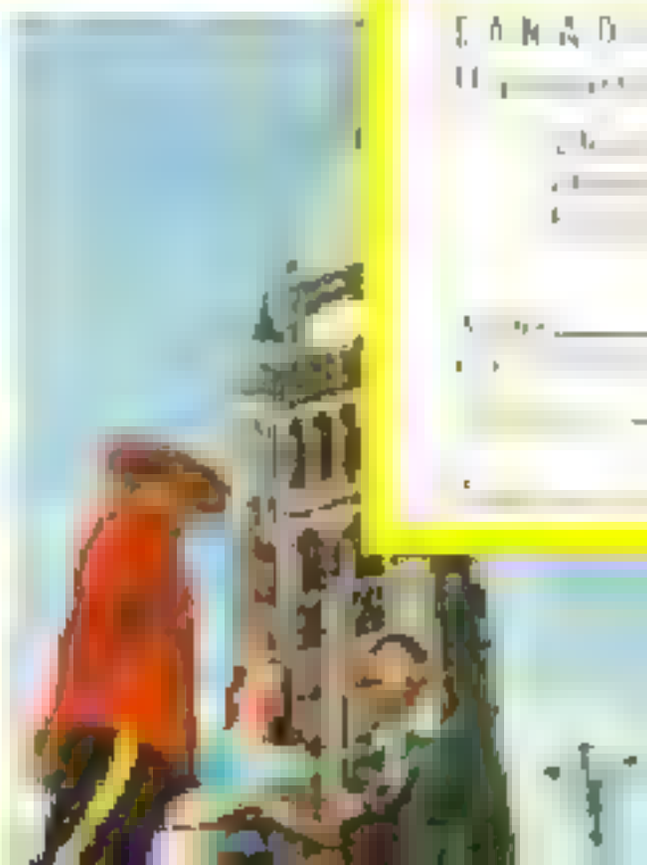
Deluxe "Day-Nite" Coaches and private All-room Pullmans let you choose accommodations to fit your family and finances. Two smart lounge cars afford extra pleasure for both Pullman and Coach passengers on the faster North Coast Limited.

For rates, schedules and more information about western vacations, see your local travel or ticket agent, or write . . . G. W. Rodine, Passenger Traffic Mgr., Northern Pacific Railway, Dept. 702, St. Paul 1, Minn.

NORTHERN PACIFIC

NORTHERN PACIFIC RAILWAY *Main Street of the Northwest*

...relax in Canada



CANADIAN GOVERNMENT TRADE BUREAU

Every Day is Father's Day

[illegible]

Every Day is Mother's Day

[illegible]

Every Day is Teen-Agers Day

[illegible]

Every Day is Youngsters Day

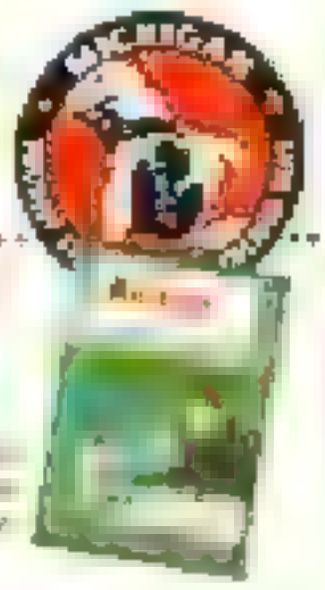
[illegible]

From your first moment in Michigan, you'll know the distinctive charm that has made this nature blessed state the Nation's favorite family playground.

Each new hour offers opportunity for active sport or relaxation. Michigan's vacationland hosts have complemented nature's beauty with golf courses, tennis courts, bridle paths, and every other facility for round-the-clock pleasure. They've built and beautified picnic areas and friendly hotels to serve as your comfort-conditioned headquarters.

Vacations are a Michigan specialty! You can have a [illegible] Michigan [illegible]

MICHIGAN TOURIST COUNCIL



MICHIGAN TOURIST COUNCIL
[illegible]

NAME _____

ADDRESS

CITY _____ ZONE ___

STATE

[illegible]

- ☐ East Michigan Tourist Association
- ☐ Upper Peninsula Development Bureau
- ☐ Southwest Michigan Tourist Association
- ☐ West Michigan Tourist Association

Today's movies ...not yesterday's!

Today's flashing action ... today's tempo ... with today's newest development ... Bolex Stereo Movies. Industry's leaders are already flocking to see the camera's newest marvel. Here's an opportunity to be in on the beginning.

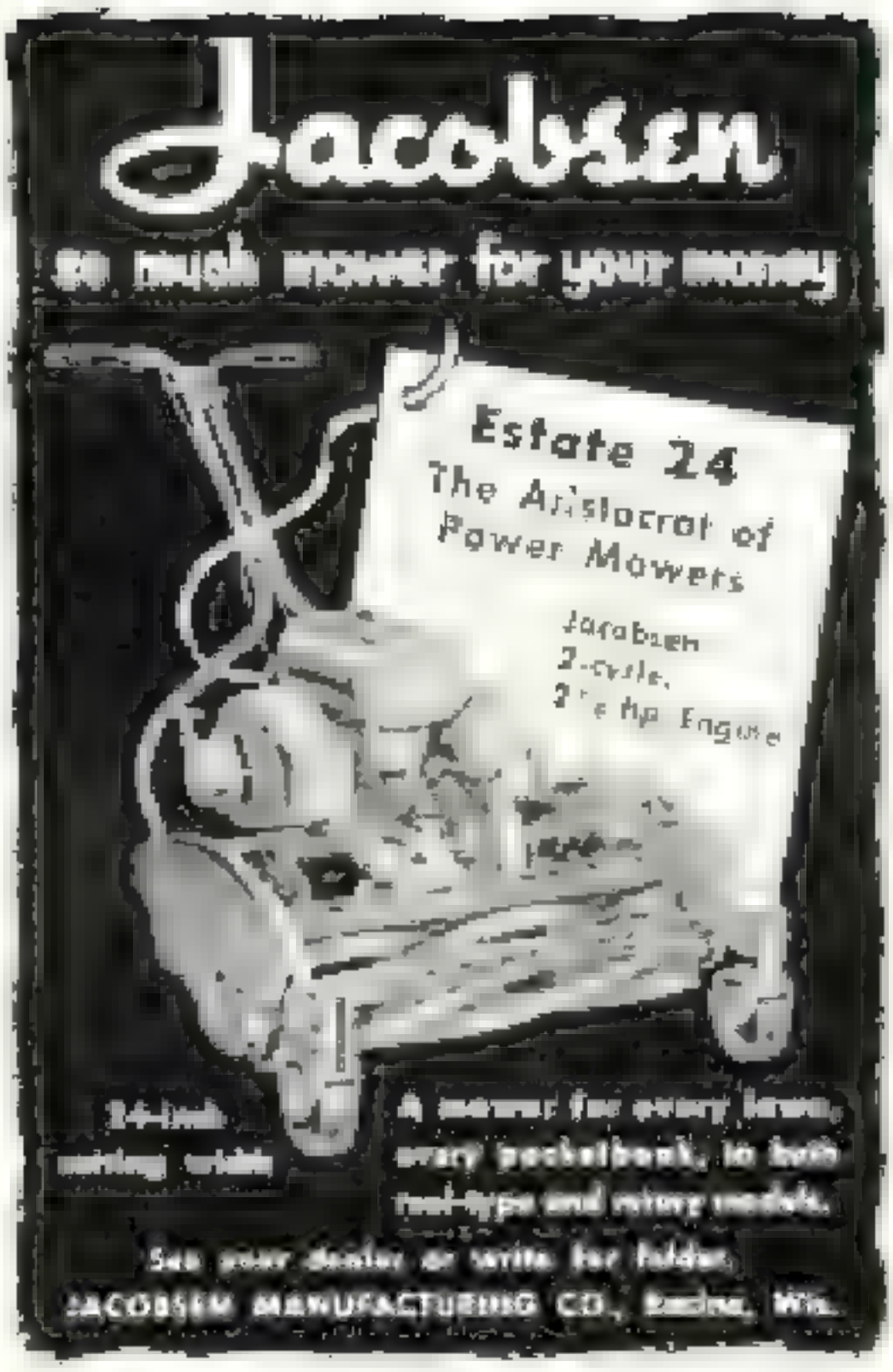
In the famous Bolex H-16 Deluxe movie camera with the exciting new Bolex Stereo System. The first complete integrated stereo movie camera ... a masterpiece of optical engineering by Kern-Paillard.

See how utterly simple it is to switch from regular movies to Bolex Stereo movies ... in full color ... using your present 16mm projector ... and with no increase in operating costs!

Bolex dealers now have regular free demos of the 25¢ magazine "Bolex Reporter" by registering serial numbers with us. (Dealers ... please ...)

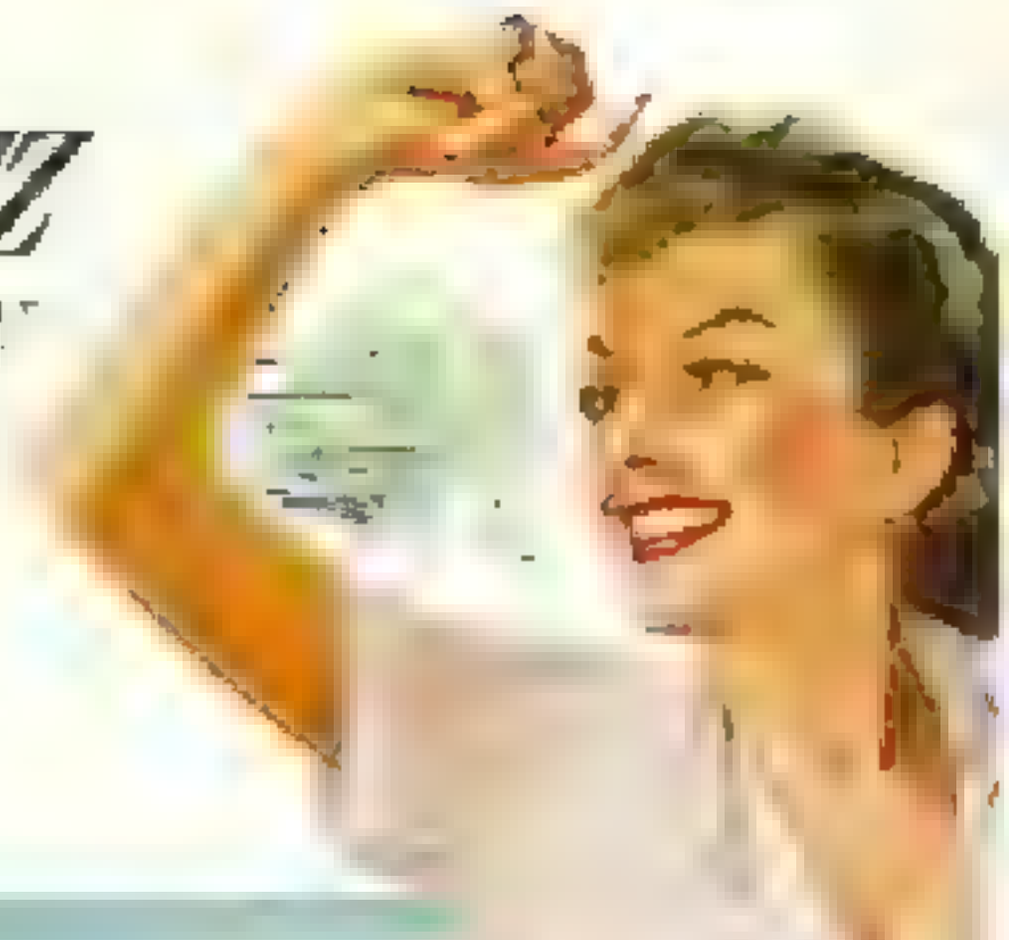
Be first...to enjoy 16mm home movie

Bolex® Stereo!



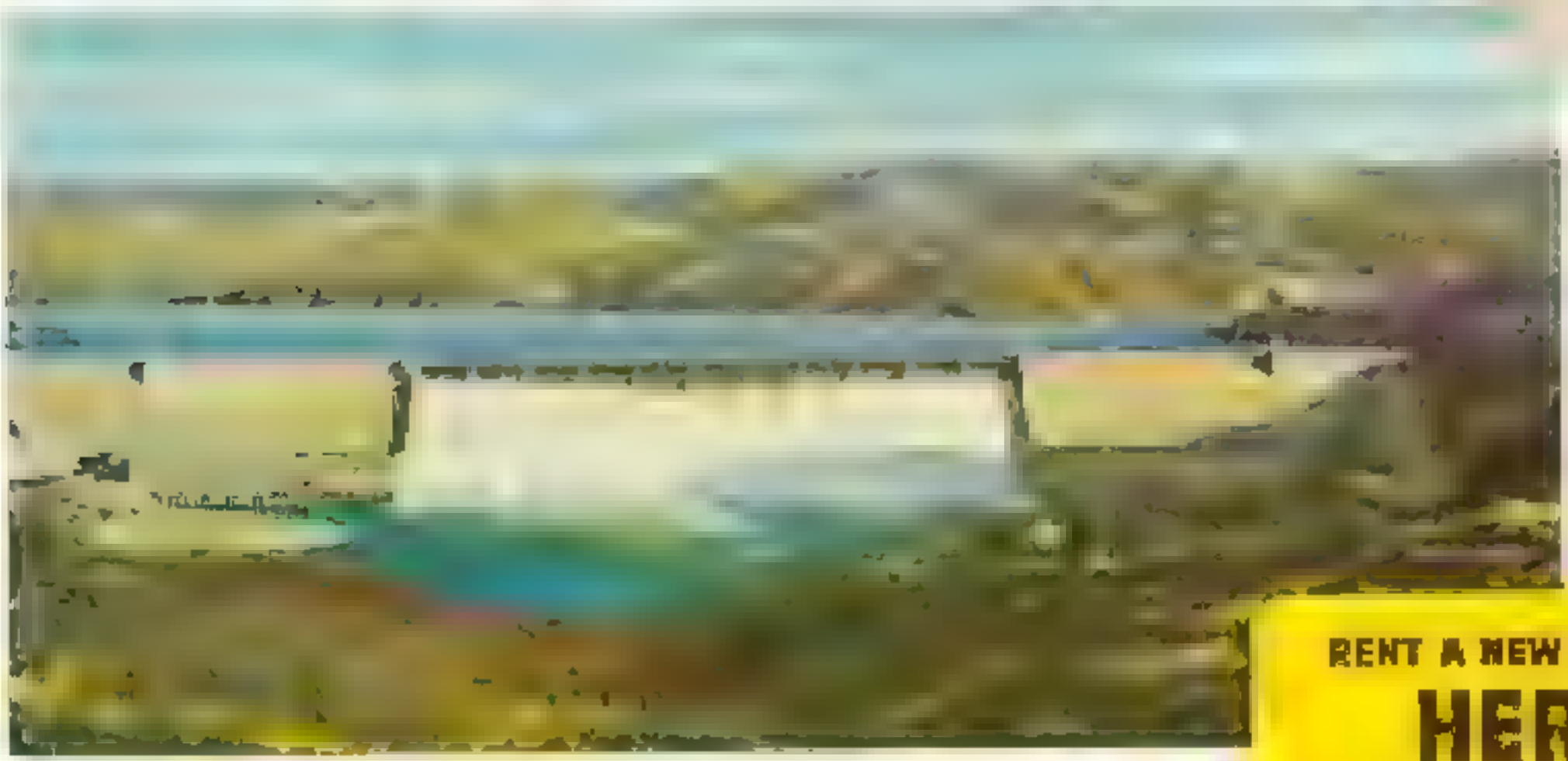
Smart travelers use HERTZ

to see more... do more... have much more FUN



[illegible] the byways as well as the highways [illegible] however [illegible] that are not in the cost [illegible] another words — see more, do more, have much more fun [illegible] in a fine new private car [illegible] by Hertz. [illegible] the practical, carefree way to travel because of the surprisingly low [illegible] rents. In most Hertz cities you can enjoy 700 miles of [illegible] period of one week for as little as $[illegible] — or $2.00 per [illegible]

[illegible] Hertz Service [illegible]



Grand Coulee Dam, over 227 [illegible] built by man, [illegible] 550 feet high [illegible] waters of the great Columbia River

RENT A NEW CAR FROM

HERTZ

...drive it as your own

HERTZ SERVICE: what it is, what it costs, how to get it . . .

What It Is — Hertz is the best car service international [illegible] in the United States, Canada, Alaska, Hawaii, Great Britain, Mexico and Switzerland.

What It Costs — Here are specific rate examples at the Hertz [illegible] plus 2 cents per [illegible] mile. Thus the total cost for a trip of 30 miles in any one day is only $2 [illegible] the week. Rates are slightly different [illegible]

Gasoline, Oil, Insurance Furnished — [illegible] whatever amount you pay for additional gasoline and oil is refunded to you. Full comprehensive Property Damage, Fire and Theft Insurance and $100.00 deductible collision protection are included at the low rate—at no extra cost.

How To Get It — It's as easy as A-B-C to rent from Hertz: (A) [illegible] your telephone directory [illegible] your nearest Hertz station, (B) show your driver's license at the station and identify yourself, (C) step into a fine new car and go.

Advance Reservations — In the case of a car when you need it most, at a time when it's hard to make a reservation in advance, Any Hertz station will make a reservation for you at others, but are free. Or, if you have the correct Hertz [illegible] your own reservations by letter, telegram or telephone. Also any railroad or airline reservation office will make a Hertz reservation for you through the Hertz Rail-Auto Plan or the Hertz [illegible] Always rely on Hertz when you make your reservation and be sure to get Hertz service when you arrive at your destination.

New Model Cars — Convenient from Hertz are a wide variety of [illegible] makes. Take advantage of Hertz ideal location—it is your private car, for an hour, a day, or as long as you wish.

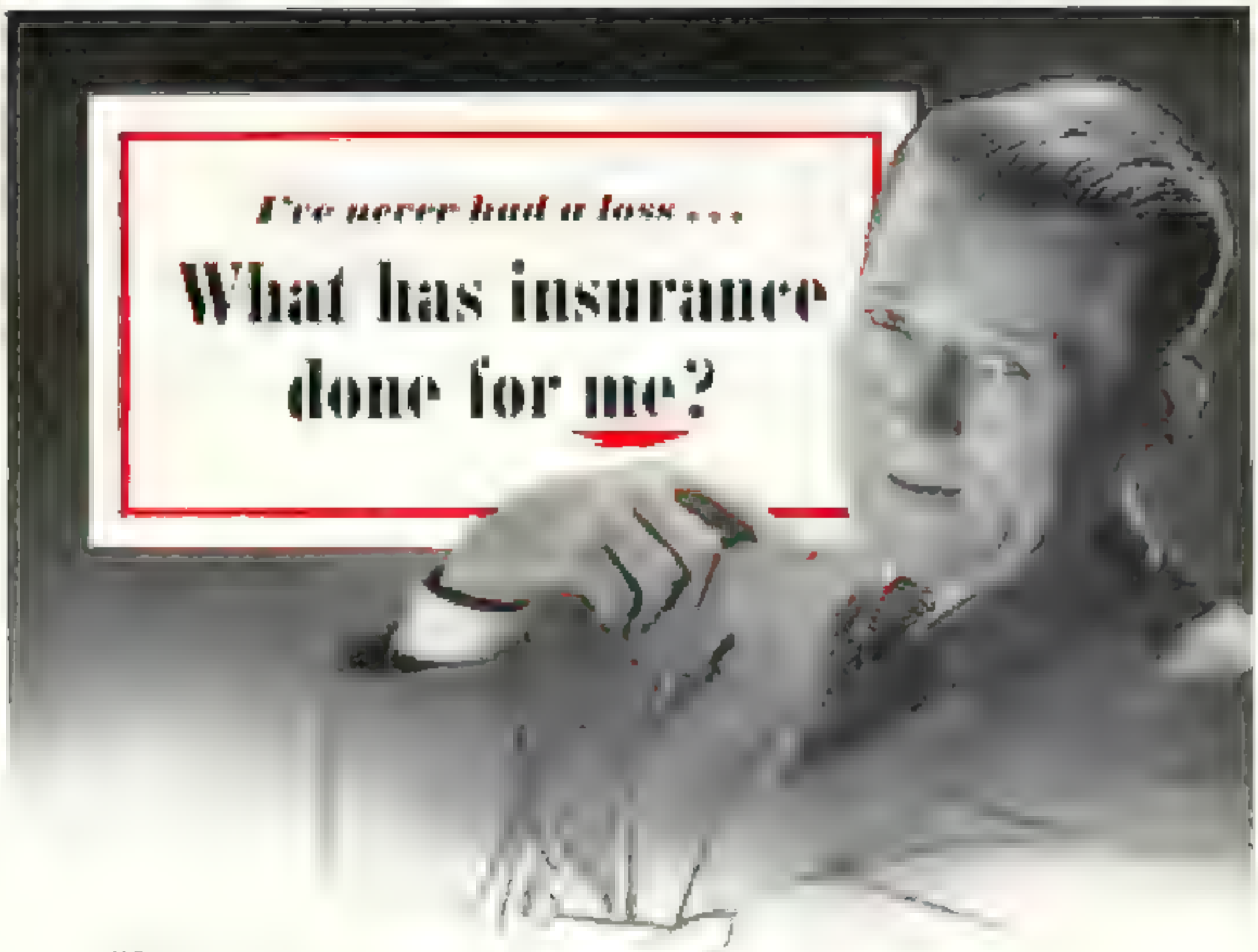
Charge Cards Available — Hertz Charge Cards [illegible] individuals. The card serves as identification, eliminates deposit requirements, and provides credit privileges if desired. All Travel Card holders and Rail Credit Card holders are accorded the same privileges extended to holders of Hertz Charge Cards.

Additional Information — For information on Hertz stations — anywhere — or for information on any detail of Hertz Service operations, contact your nearest Hertz station or — write or phone Hertz Rent-A-Car System, Inc., Department [illegible], 218 South Wabash Avenue, Chicago 4, Ill., phone WEbster 9-5165.

Look in your telephone directory under "H" for your nearest Hertz station

HERTZ *Rent-A-Car* **SYSTEM**

WHEREVER YOU GO — WHATEVER YOU DO — YOU CAN RENT A NEW CAR FROM HERTZ AS EASY AS A B C



Though you have never suffered a loss, your insurance premium buys many things you would not wish to be without.

Use it as protection against misfortune—the building that *did not* burn; the elevator that *did not* drop; the boiler that *did not* explode; the dangerous manufacturing process made safe for workers; the accidents at a bad intersection that were prevented; the wiring or appliances that did not fail and destroy your home.

These and myriad other mishaps in which you or yours might have been involved, did not happen because the unerring vigilance of insurance inspectors and engineers prevented them.

Added to this, the greatest payment insurance makes to you is freedom from worry—a feeling of security—peace of mind!

America Fore
INSURANCE GROUP

100 YEARS

1953 marks 100 years of proven insurance protection by two America Fore Companies: The Continental and the Fidelity-Phenix.

For the name of a nearby America Fore Insurance Man call Western Union by number and ask for Operator 25.

★ The Continental Insurance Company ★ Fidelity-Phenix Fire Insurance Company

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Vacation Dreams Come True in MISSOURI

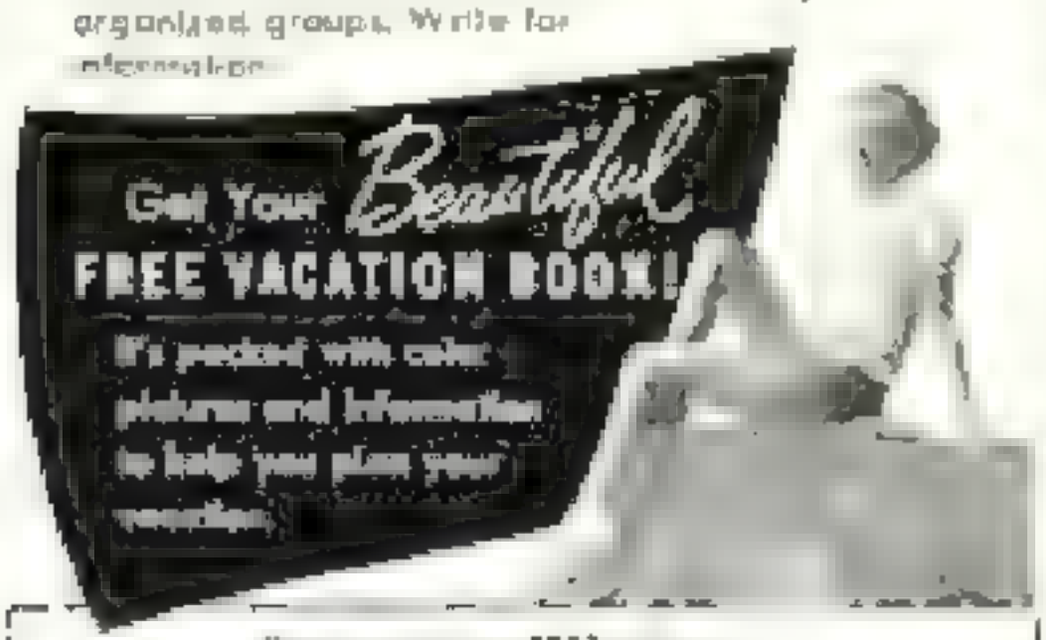
HEART OF AMERICA

Where FUN'S SERVED FAMILY-STYLE!

Junior hunts for arrowheads and forgotten treasures. Dad feels the surge of a scrappy smallmouth at the end of his fishing line. Sis photographs "granddad gull" at the beach. Mom relaxes in the woodland coolness.

Everyone happy in Missouri, and the cost is just about up to you. Choose from Missouri's wide range of hotels, lodges, resorts and cottages — every one will help your vacation budget go farther.

FREE color movies of Missouri vacation lands are available to organized groups. Write for information.



Please send me a FREE copy of BEAUTIFUL VACATION BOOK.

Name

Street

City

State

MISSOURI DIVISION OF RESOURCES AND DEVELOPMENT

Dept. E342 Jefferson City, Missouri

ENJOY the Lasting Satisfaction of an Eclipse

ROCKET 20"

An entirely new concept of the fast-as-you-can-push power mowing

Unmatched Performance ...

Service and Parts ...

Choice of Models ...

ONLY AN ECLIPSE OFFERS ALL OF THESE FEATURES:

- Power-driven wheels, reel and sharpener
- Finger-tip controls
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- Specially tempered blower blade
- Timken bearings in reel
- Patented Material Grip, [illegible] handle
- Positive action clutch
- Grooved shear drive
- Goodyear puncture proof tires
- "[illegible]" finish

Finish Faster ... Feel Fresher ... with an Eclipse

All the Pack Are Yours FREE!

THE ECLIPSE LAWN MOWER CO.

3035 Tilghman Street Rockford, Illinois

Choose a CRUISE through FRENCH CANADA and the SAGUENAY

See cosmopolitan Montreal [illegible] Quebec [illegible] and customs and costumes are the [illegible] country. See Arvida [illegible] the Saguenay [illegible] the Shrine of Ste. Anne de Beaupré [illegible] Mont Ste. Anne [illegible] and [illegible]

Low-cost independent or escorted tours from $[illegible]. Escorted tours with expert guides and [illegible] congenial companions.

Consult travel agent. Railroad ticket agent or

CANADA STEAMSHIP LINES

Montreal • Quebec • Toronto • New York • Minneapolis

Toronto Ont. • Detroit Mich. • Buffalo


CHOOSE
the right point
for the way
you write...
by number
ADD
it to the
barrel of an
Esterbrook
Fountain Pen
TO SELECT OR REPLACE
...HERE'S ALL YOU DO
WRITE
with the pen that
writes your way
...naturally
Esterbrook
FOUNTAIN PEN
THE WORLD'S MOST PERSONAL FOUNTAIN PEN

Invitation to disaster

(forty-three times out of a hundred)

Better cross 'em right! [illegible]

[illegible]

[illegible] Mosler Safe [illegible] Label [illegible] Mosler dealer in your city, or write [illegible]

IF IT'S MOSLER ... IT'S SAFE

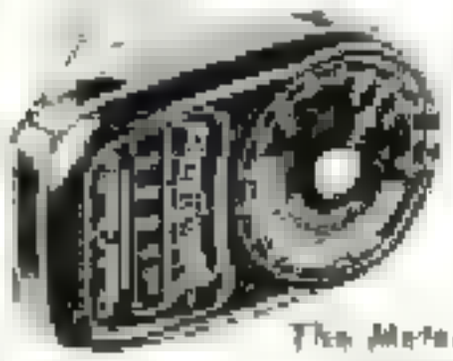
Mosler Safe

[illegible]

This Spring

be true to your colors!

It's [illegible] costly color film. Use a WESTON Exposure Meter and be [illegible] ... with every picture sharp and [illegible] and all your colors true. [illegible] a WESTON at your local camera store today.



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EXPOSURE METERS

The Meters Most Photographers Use

America's Greatest Family Resort

OCEAN CITY

NEW JERSEY

[illegible] Virgin White Sand Beaches ... Clean Swimming Surf. Excellent Swept Boardwalk. Lined with Pretty Shops. All Sports. Healthful Entertainment. Beautiful Hotels, Cottages, Apartments. No Bathhouses. No Bars. No Liquor Stores.

Write for Free Illustrated Booklet

Dept. [illegible] Boardwalk, Ocean City, N. J.

Drive through the

AVENUE OF THE **GIANTS**

[illegible]

HUMBOLDT COUNTY

Chamber of Commerce

EUREKA, CALIFORNIA

Leica

CAMERAS
LENSES
ACCESSORIES

Your family is in for a great vacation

Come to WONDERFUL WISCONSIN where the temperature does not exceed 80° during the summer months. Average 68°. Enjoy every type of recreation, including swimming, boating, fishing, golf, tennis, horseback riding, hiking, camping, hunting, sightseeing, etc. Unsurpassed scenic beauty . . . interesting towns, exhibits and museums. Excellent accommodations and cuisine at reasonable rates, not high, moderately priced

Wonderful WISCONSIN

WISCONSIN CONSERVATION DEPARTMENT
Recreation Section
Room 7-3, State Office Bldg., Madison 3, Wisconsin

Name .....
Address .....
City ..... Zone ..... State .....

Send today for FREE BOOK

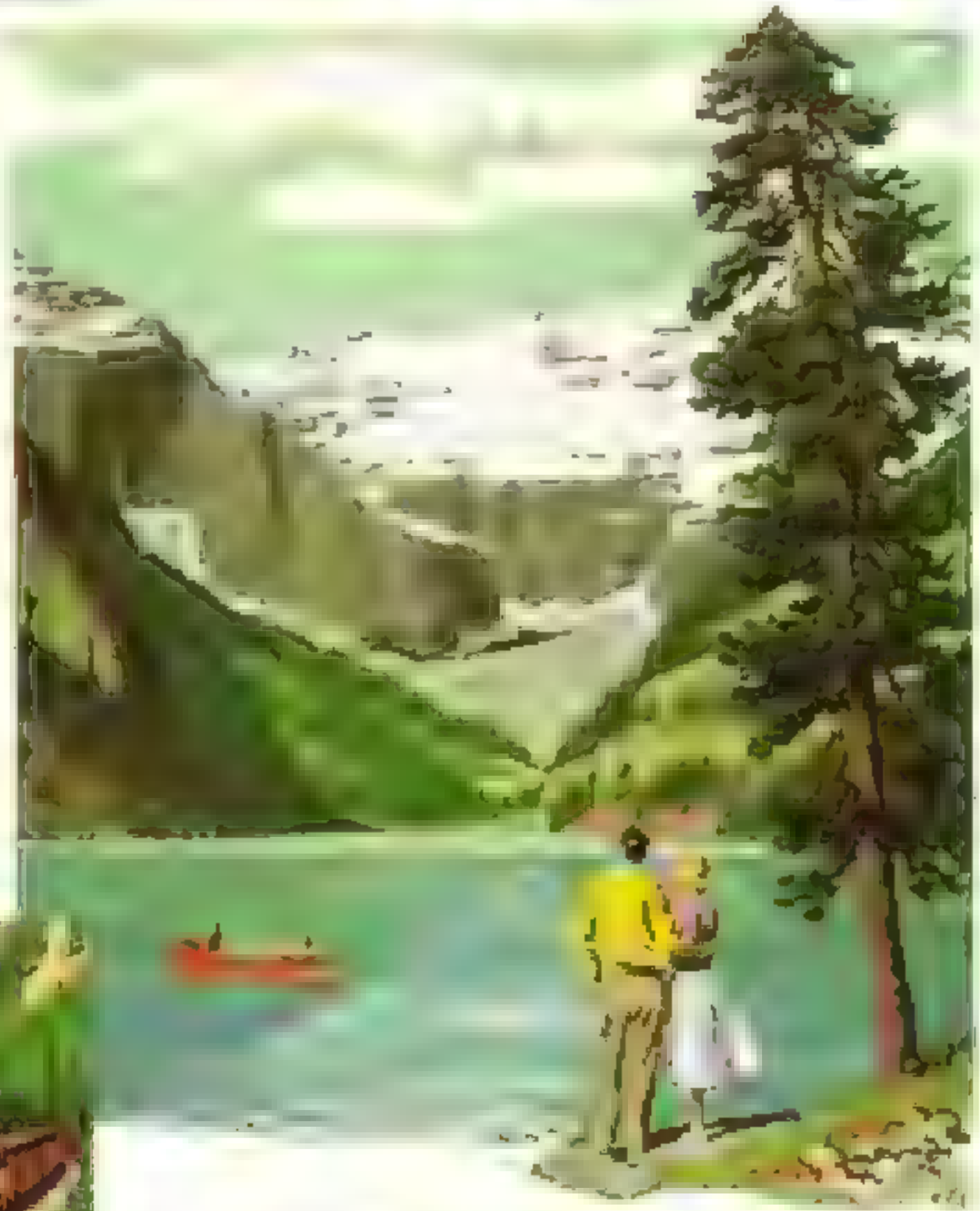

destination . . .
VACATION
transportation . . .
TRAILWAYS
THRU - LINERS
the Smartest distance
between two points
FOR CONVENIENCE — Thru-liners travel direct routes to your destination. No change of bus or baggage
FOR COMFORT — Restful relaxation is yours to enjoy aboard modern, air-conditioned Thru-liners
FOR SAFETY — Thru-liner travel is America's safest means of transportation
FOR ECONOMY — Have more money for fun on your vacation. There are no lower fares
Mail coupon for your choice of
TRAILWAYS All expense tours
TOMMY THRULINER:
"Your highway host from coast to coast."

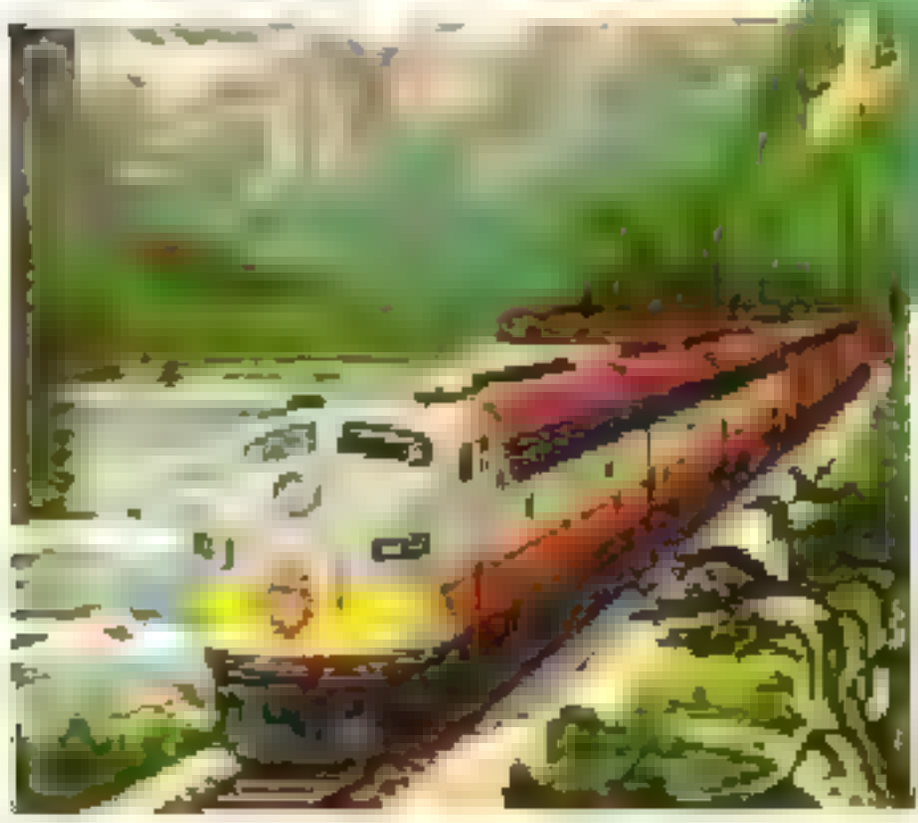
CANADA

passes your train window...

You can afford to see [illegible] Canada. To aid the budget, Canadian Pacific [illegible] tourist sleepers and [illegible] Spectacular Canadian Rockies! Montreal [illegible] Canadian Pacific service!

Great picture-window views—all [illegible] Canadian Pacific train! East-to-West, there's [illegible] walled Quebec metropolitan Montreal, North Shore of the Great Lakes, the [illegible] plains, you mile-high into the shining Canadian Rockies!





Canada is news! See it by

Canadian Pacific

Stop off at Banff or Lake Louise [illegible] tours on the Canadian Rockies. Marvel at [illegible] Kicking Horse Pass, Emerald Lake, other grandeurs. *Play in mountain sunshine.* [illegible] golf at famous *Banff Springs.* You can [illegible] enchanting *Chateau Lake Louise.* Or [illegible] comfort at any of seven [illegible] lodges. Have the time of your life—in Canada, land of [illegible]!

Ask your agent about Empress [illegible] Canadian Pacific [illegible] in down East Canada.

[illegible]

Get the best out of your mind with this different dictating machine!

Your success depends not just on what's in your mind but what you get *out* of your mind—how well you *communicate*! And that's why the Dictaphone TIME-MASTER is the run-away favorite of busy people.

Just pick up the tube, talk, and you'll soon find out how easy it is to get the best out of your mind.

TIME-MASTER is so simple to use it pays wages on your work.

Your voice comes through with PERFECTION

the new *Dictabelt*, exclusive with TIME-MASTER. Your words are transferred from *Dictabelt* to typewriter so clear that she'll think she's listening to P. M. herself.

It's an age of gimmicks and electronics, and Dictaphone Corporation has taken advantage of both in giving you the remarkable TIME-MASTER and the even more remarkable new *Dictabelt*. The inexpensive, convenient *Dictabelt* can be used once and thrown away, filed or mailed.

Why wait longer? The coupon will deliver the promise promptly!

DICTAPHONE®
CORPORATION
Greatest name in dictation

IT'S SAID—

AND DONE!

[illegible] N. Y. 18, N. Y.
[illegible]
☐ [illegible]

Name [illegible]

Company [illegible]

Street [illegible]

City & Zone [illegible] State [illegible]

How "young" will they be at 65?

Younger people today have an excellent chance to live beyond their sixty-fifth birthday. Already there are over 12 million Americans who are past 65. By the end of the century, it is estimated that there will be nearly twice as many.

Most of these millions can look forward to being healthier, happier, "younger" after 65 than people of that age have ever been. This has been made possible chiefly by medical advances.

If you are one of those to whom the words "old age" conjure up an unpleasant picture, you are likely to be heartened by the views of authorities. They say that old age need not be *endured*; that it can actually be *enjoyed*. This depends largely, however, on what you do to safeguard your health.

Over the years, adjustments in diet may be desirable. While the *quantity* of food required in later life usually becomes less, the need for the essential proteins, vitamins and minerals remains unchanged.

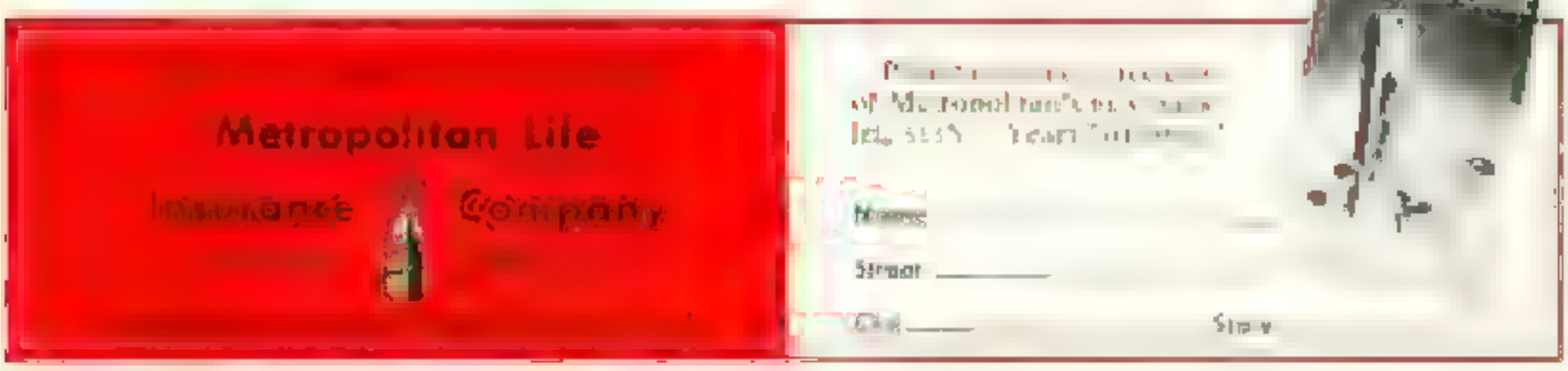
Moreover, [illegible] guard against [illegible] which burdens the heart and often paves the way for [illegible] and high blood pressure.

Of course the best way [illegible] serve good health is to place [illegible] under your doctor's care and go to him for a periodic health examination as often as he recommends it. By following this through the years, your doctor will also come to know you as an *individual* . . . what your personal problems are, what strains your work places on you, what your reactions are [illegible] times of stress. Such information is of great value to the doctor in solving [illegible] health problems.

He can also advise you about some daily habits, such as getting plenty of rest and sleep and practicing [illegible].

[illegible] depend upon one's [illegible] attitude. This is why it is important to keep up your outside interests, including hobbies. [illegible] will help you [illegible].

[illegible] of life should we take good health for granted? Rather, we should plan and work for it, just as we do for the other [illegible] while in the prime of life. By doing so, [illegible] have even in [illegible], and [illegible].



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